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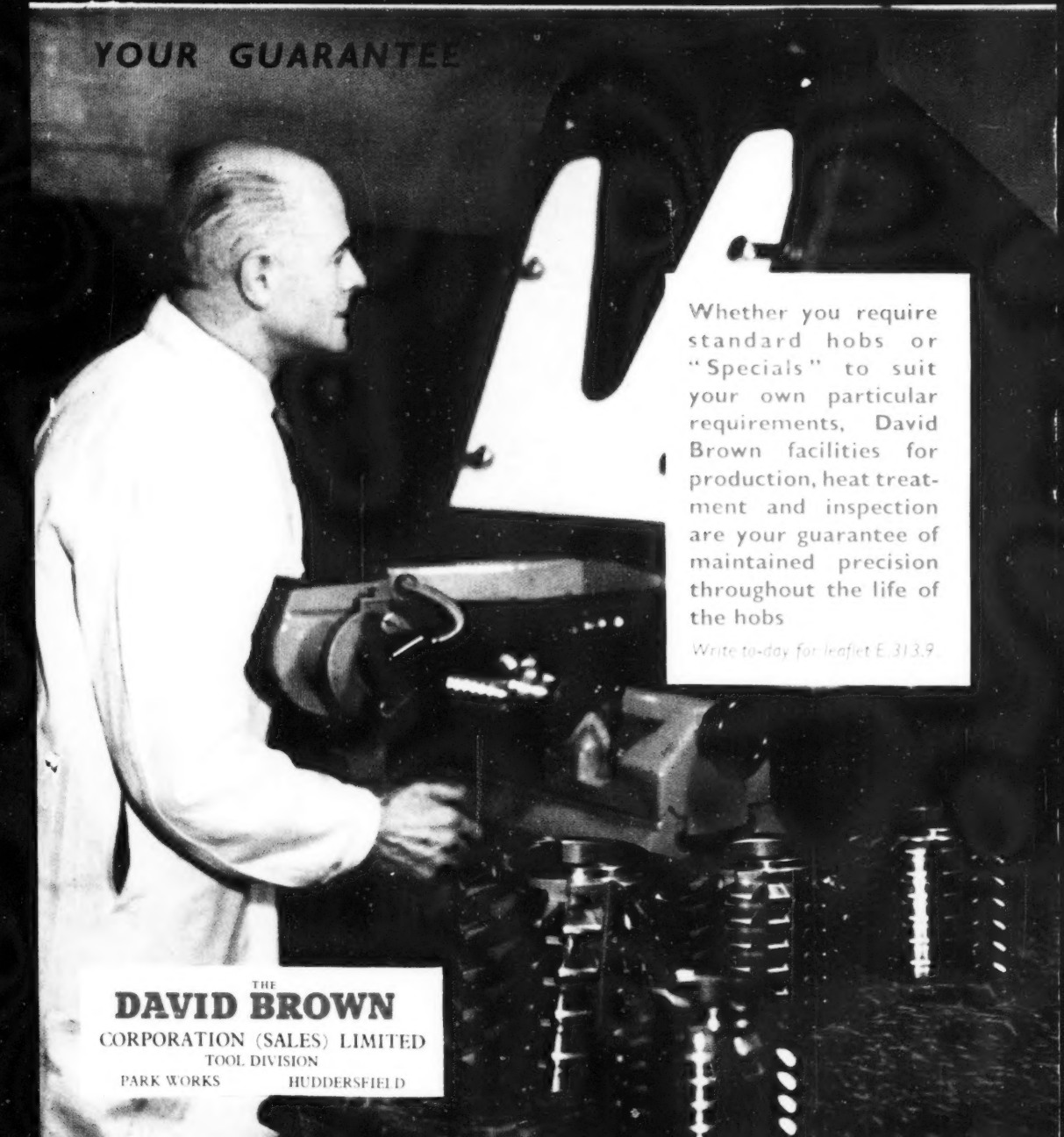
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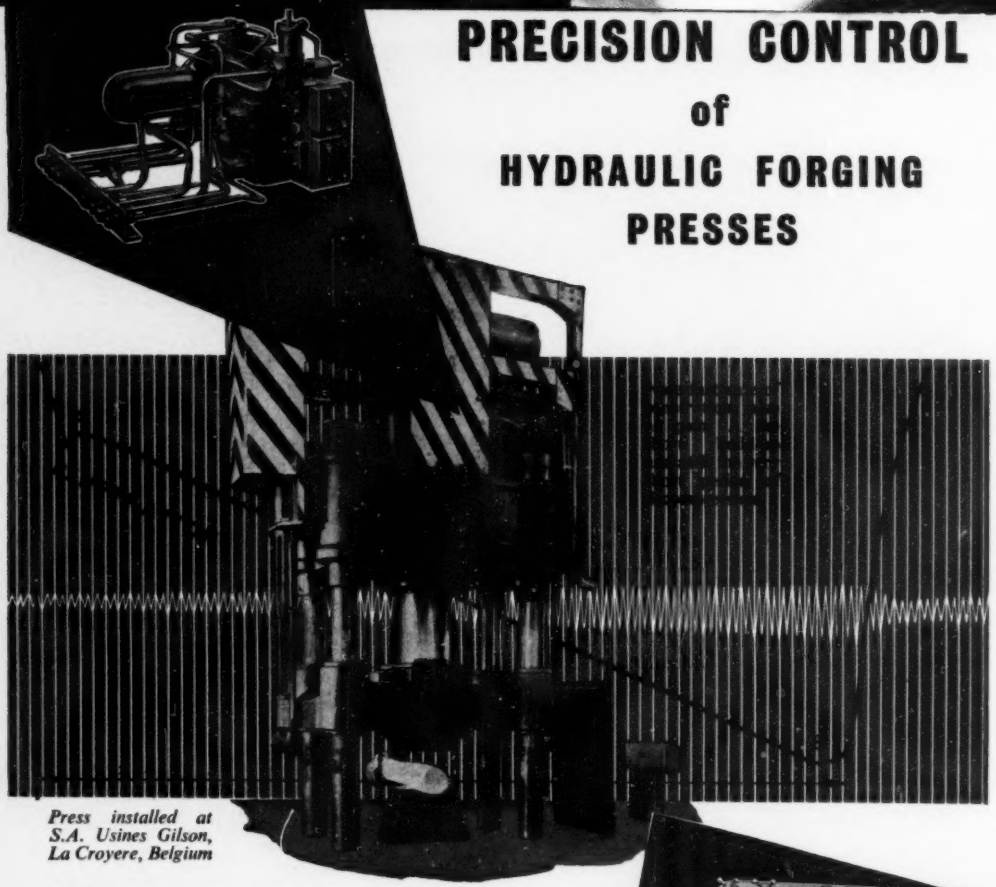

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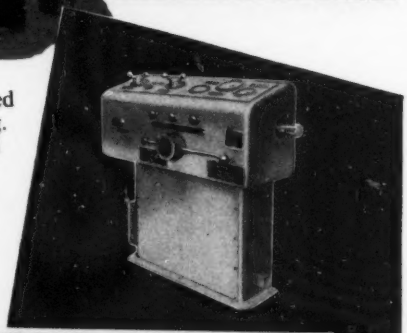
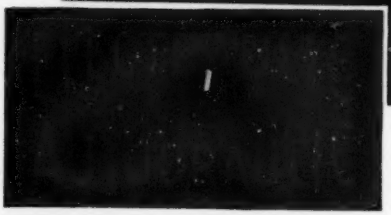
The Towler direct-oil Hydraulic system of control applied to Forging Presses greatly simplifies precision forging. The advanced design and layout of the Towler control gear ensures rapid application of pressure, giving a high rate of billet penetration; this combined with rapid decompression of the cylinder gives a minimum tool contact time on the billet resulting in higher outputs from the press.

This was proved yet again by tests carried out on the 1,200 Tons Press illustrated above.

Forgemasters will be interested to know that this hydraulic press will forge satisfactorily 18/4/1 High Speed Steel.





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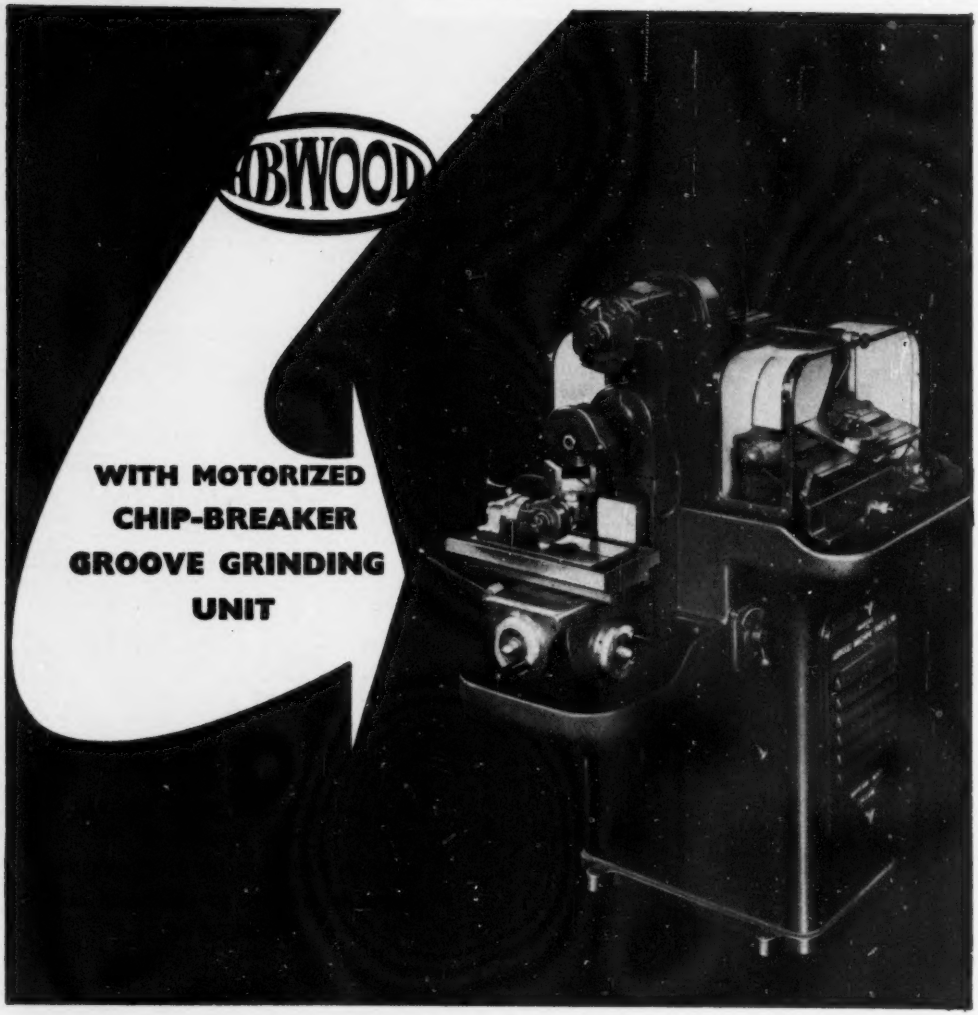
WITH MOTORIZED CHIP-BREAKER GROOVE GRINDING UNIT



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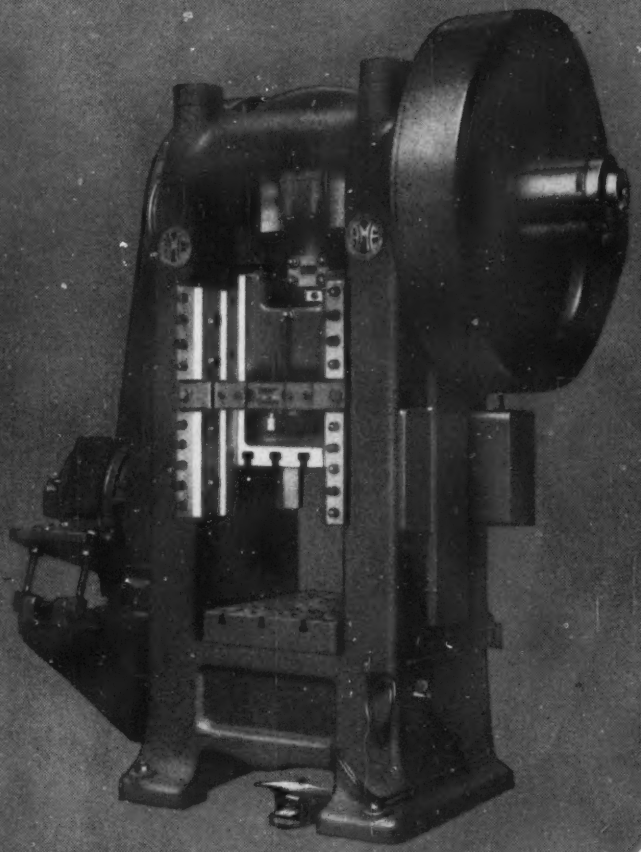
C9/1

200 TON PRESS

MODEL C.28



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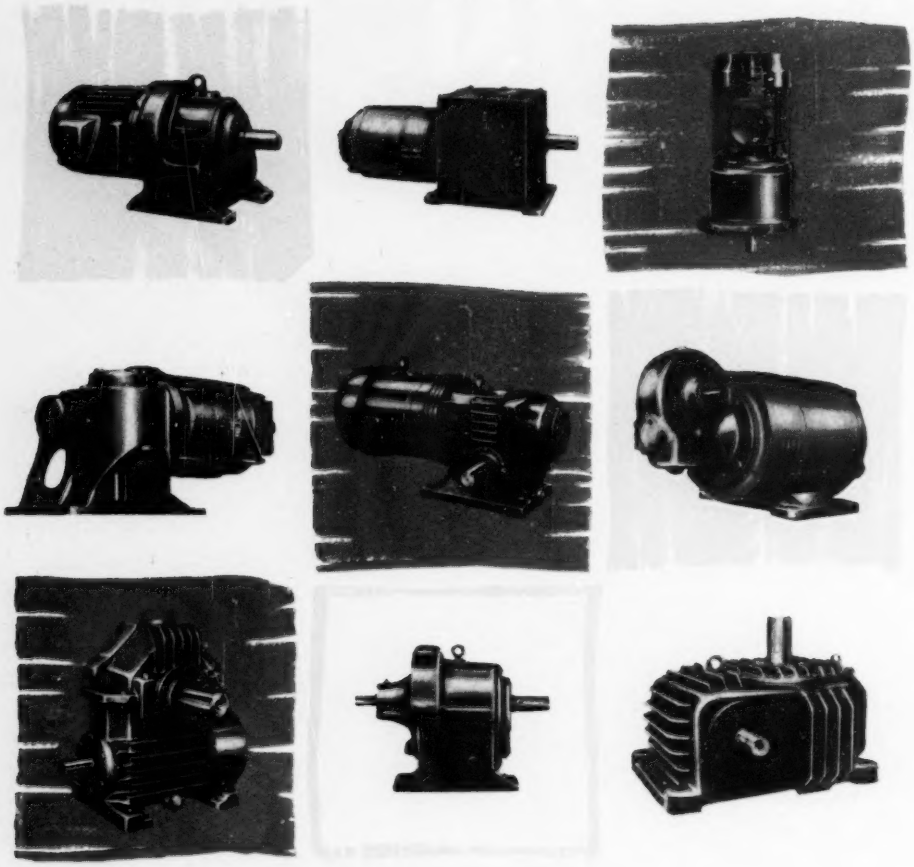

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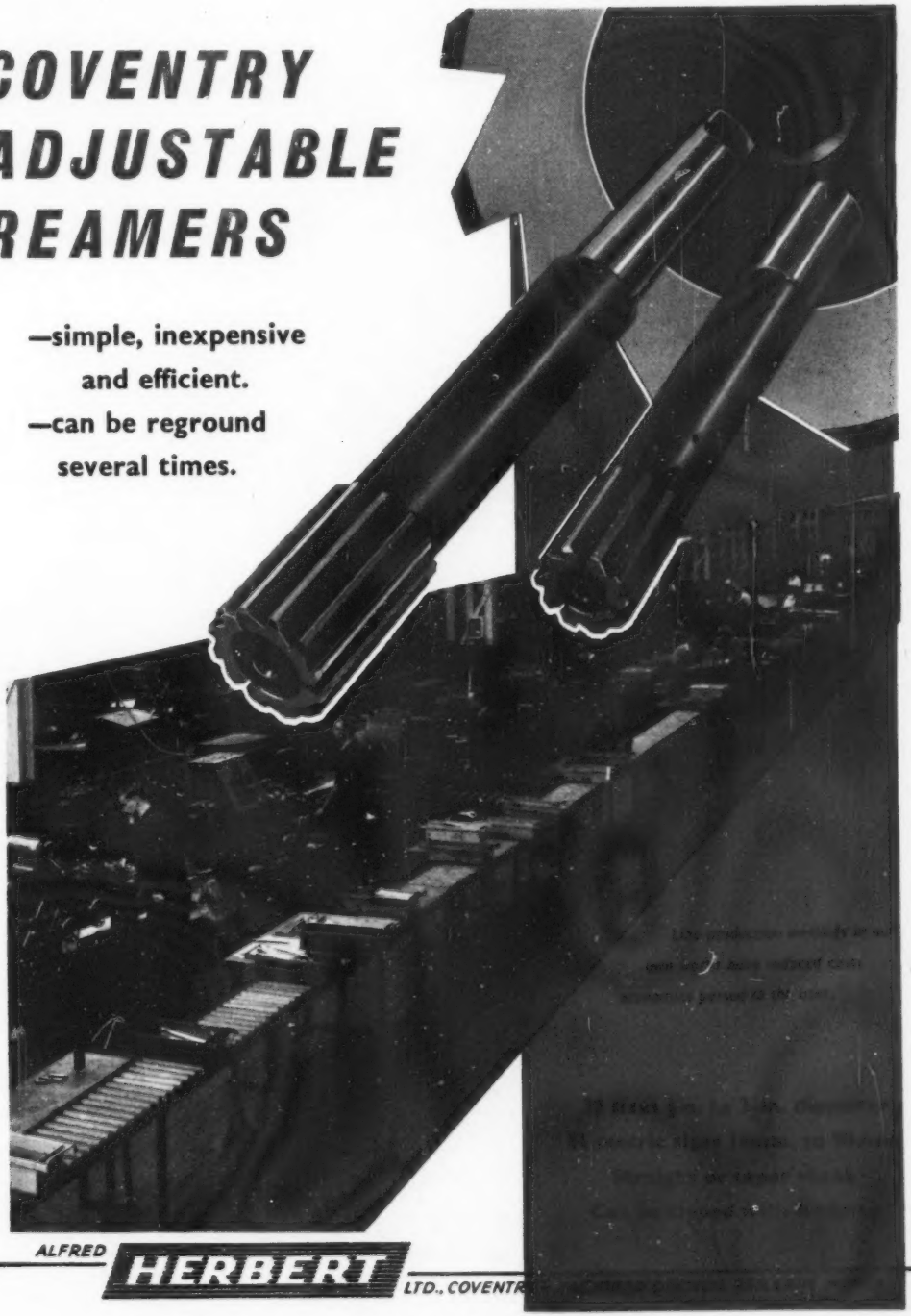

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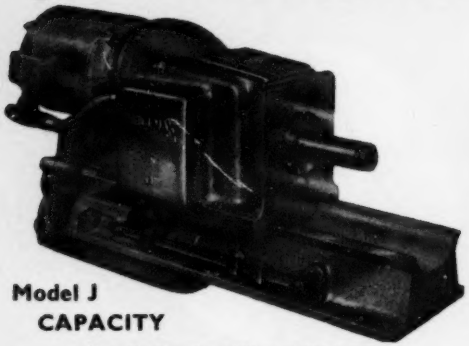

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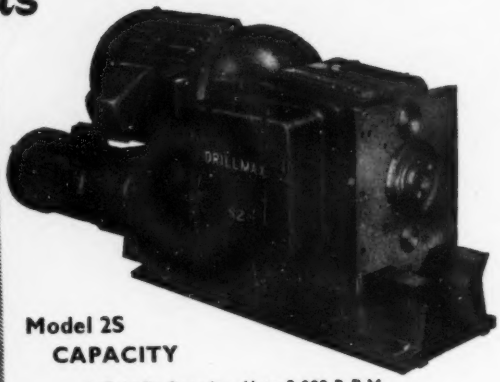
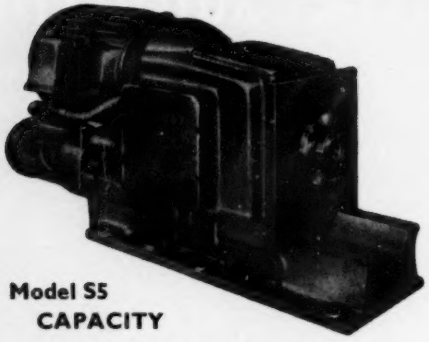
- 9in. Max. Standard Stroke
- Morse Taper or Multi-Head Spindle Nose



Model 2S
CAPACITY

- Spindle Speeds: 41 to 2,000 R.P.M.
- Feed Range (Drilling or Tapping) 0·0022 to 0·110 per rev.
- 1½ to 3 H.P. Main Motor
- 6in. or 12in. Standard Stroke
- 2⅛in. Milling Machine Type Spindle Nose



Model S5
CAPACITY

- Spindle Speeds: 41 to 1,500 R.P.M.
- Feed Range (Drilling or Tapping) 0·0022 to 0·110 per rev.
- 3 to 7½ H.P. Main Motor
- 9in. or 15in. Standard Stroke
- 3½in. Milling Machine Type Spindle Nose

Model S15
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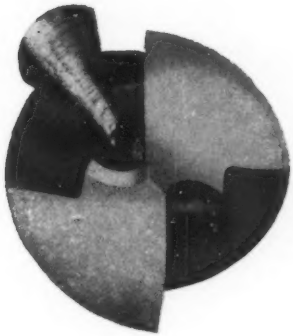

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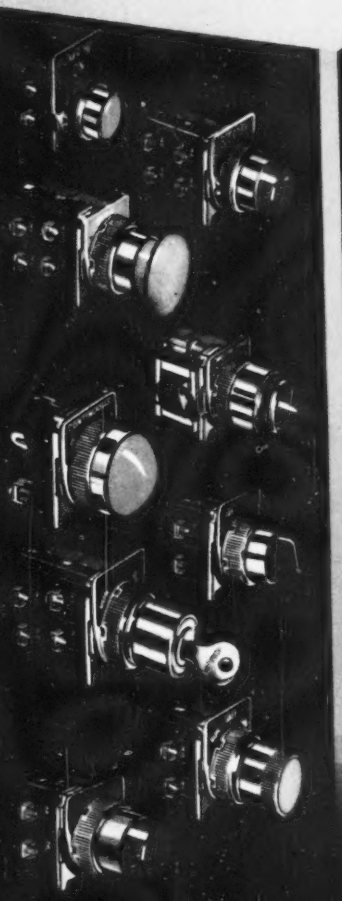

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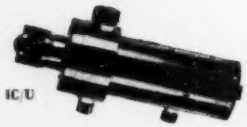
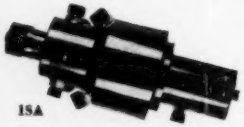
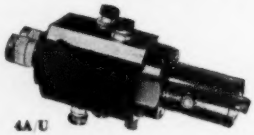

1C/U

2A/U


1SA

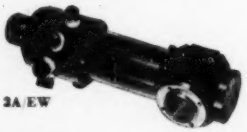

4A/U

2A/E

2A/S/S

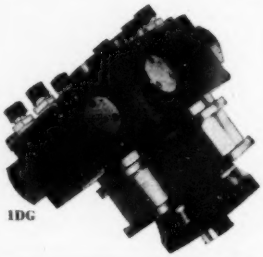
2A/ES

for Horizontal Copy Milling


3A/EW

2A/EW/S

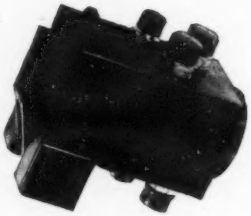
360° Profile Milling


1DG

for Copy Shaping

2A/R

for Copy Turning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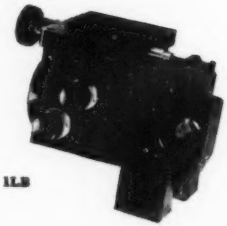
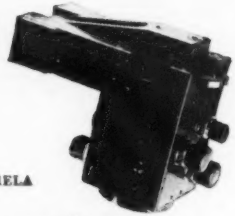
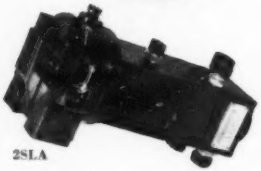

1LB


1ELA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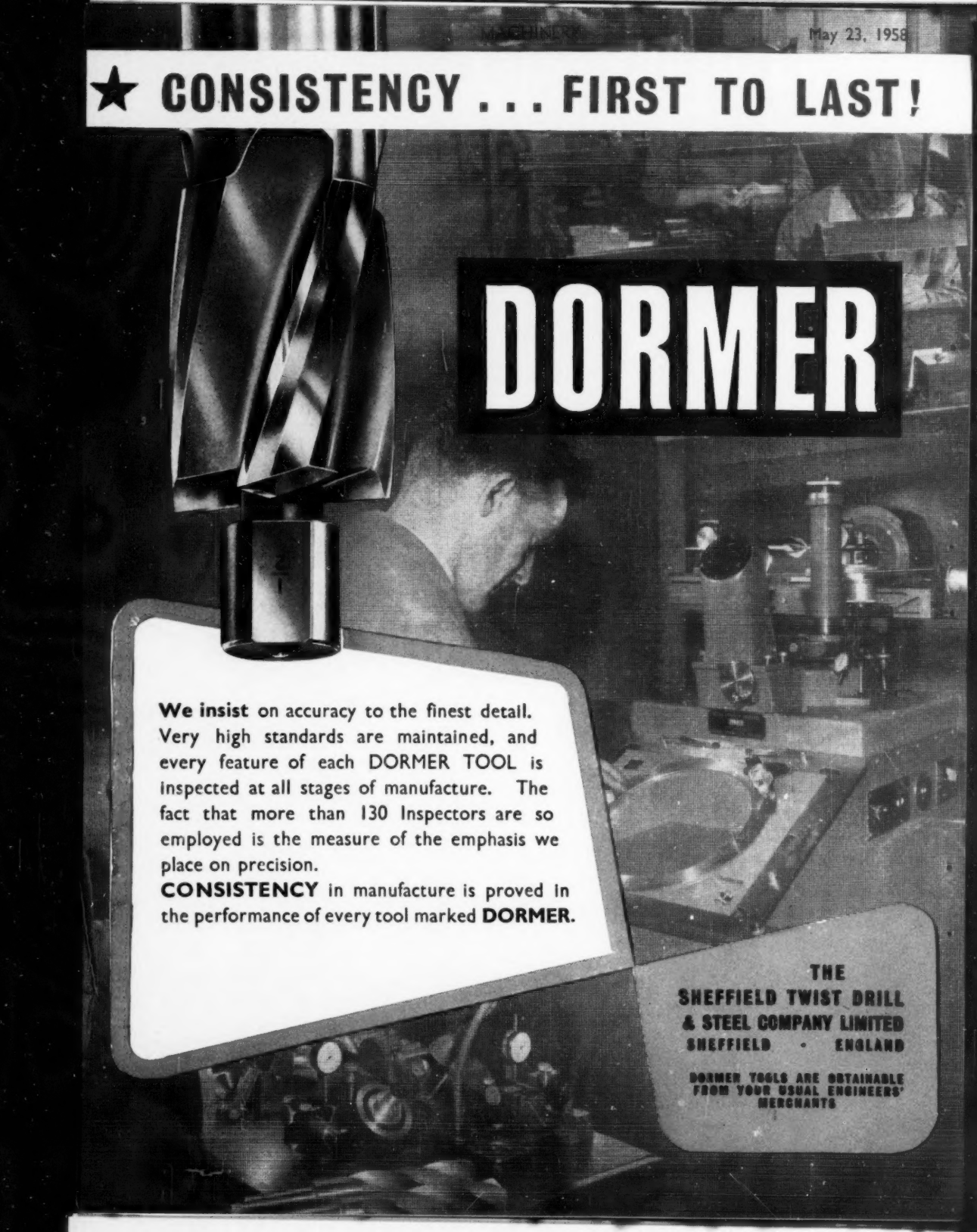

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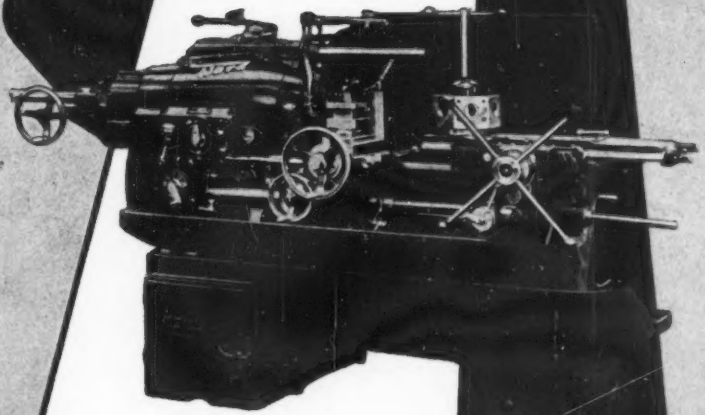

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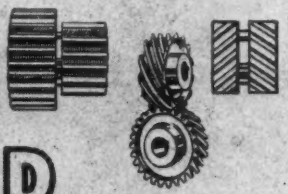

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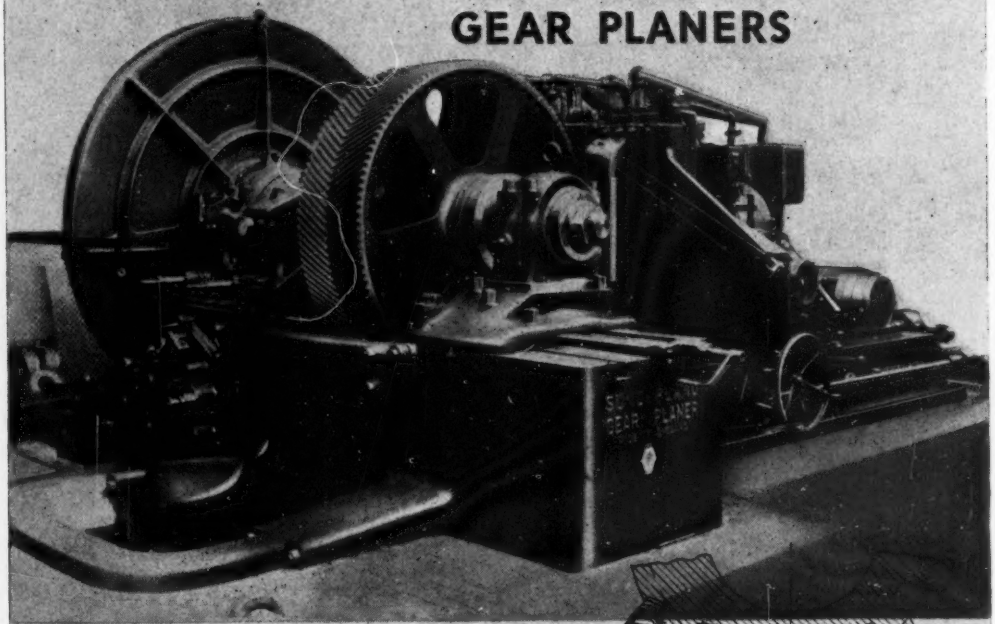

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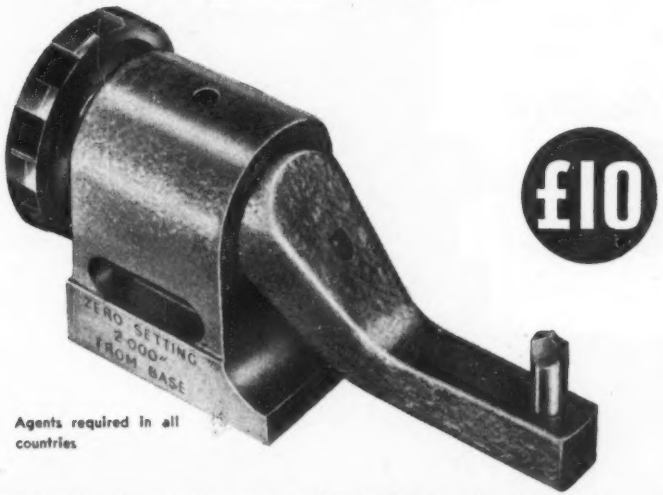

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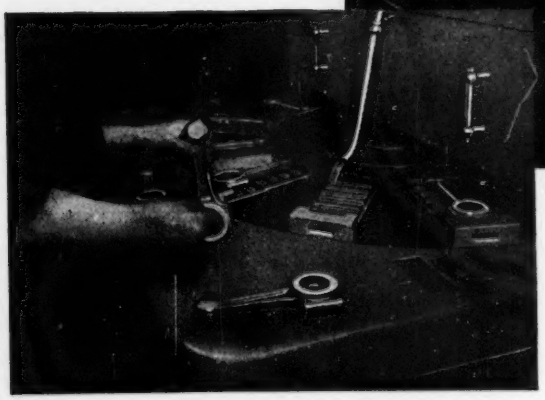

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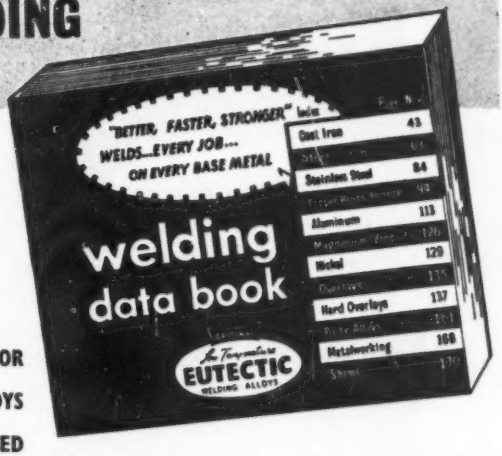

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NORTH FELTHAM TRADING ESTATE
FELTHAM · MIDDLESEX

Please send my free copy of the 180-page "Eutectic" Welding Data Book.

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MAC.1

BLOCK 'C' BRITISH INDUSTRIES PAVILION BRUSSELS UNIVERSAL EXHIBITION

EUTECTIC WELDING ALLOYS CO. LTD.

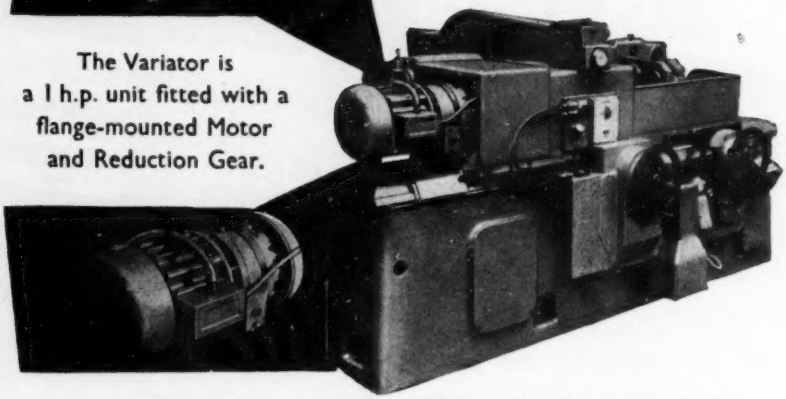
NORTH FELTHAM TRADING ESTATE, FELTHAM, MDDX. *Telephone FELtham 6571*

No. MAC 4

Kopp
variable speed gear

FITTED BY
NEWALL OF PETERBOROUGH
TO THE 3-D TURBINE
BLADE GRINDER

The Variator is
a 1 h.p. unit fitted with a
flange-mounted Motor
and Reduction Gear.



Stepless speed variation over a 9 to 1 output speed range (1/3 to 3 times the input speed).

Constant horse-power transmitted throughout the speed range.

Flange mounted motors (when required) giving output speeds from 320 to 2880 r.p.m., and from 480 to 4320 r.p.m.

Low output speeds down to 1 to 9 r.p.m., or lower, obtained with reduction gears, flange mounted to the Variator.

Exceptionally light, sensitive and accurate control of speed setting.

Co-axial input and output shafts which rotate in the same direction.

Service reliability resulting from a simple design manufactured to high precision limits.

Compactness, with consequent ease of mounting as an integral part of a machine.

Vibrationless and silent performance.

Standard range 1/33 h.p. to 15 h.p.

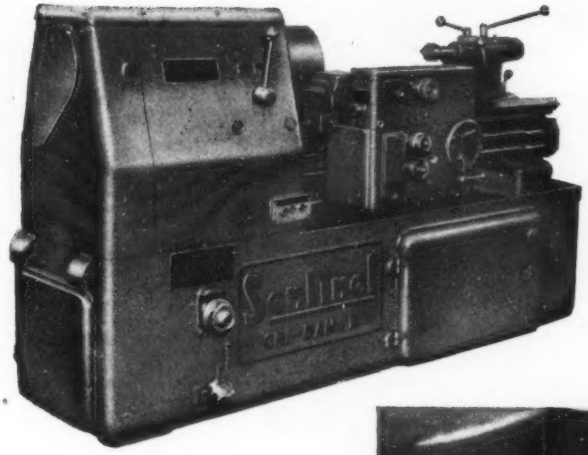
Allspeeds Limited

Oakenshore Works, Clayton-le-Moors, Accrington, Lancs. Telephone: Accrington 5441 (4 lines)

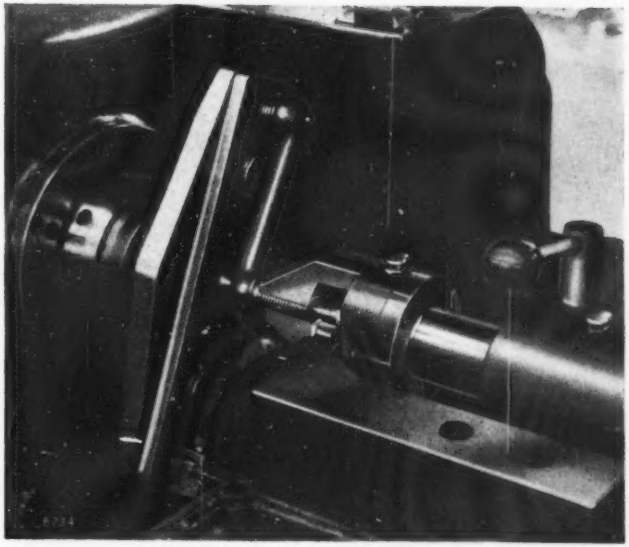
with branches at

LONDON: 59 Park Road North, Acton, W.3. Tel: Acorn 7150
SCOTLAND: P.O. BOX No. 1, Clarkston, Glasgow, Tel: Busby 2738
MIDLANDS: Much Park Street, Coventry Tel: Coventry 63091
YORKSHIRE: 46 Park Square, Leeds, 1 Tel: 3-1146, 3-0285/6

A machine that will cut any type of thread—in any material that can be threaded.



Threads can be cut in a fraction of the time taken on a thread miller or centre lathe and at less expense with greater accuracy and superior surface finish.



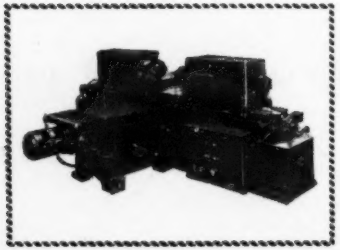
This set-up on a Cri-Dan type-B is for cutting a $\frac{1}{16}$" dia. 11 t.p.i. x 1.390" long thread at both ends of a steering idler at a rate of 48 per hour.

Over 500 Cri-Dan high-speed threading machines have been installed in customers' works since 1948. This machine combines an old-established principle of cutting a thread with modern tool development. This enables threads to be generated at very high rates of production using semi-automatic cycle and unskilled labour.

Cuts threads up to 5 t.p.i. in mild steel on 4" external and 6" internal diameters and up to 3½" in length.

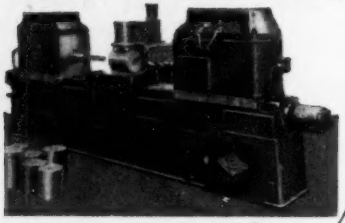
AD.347

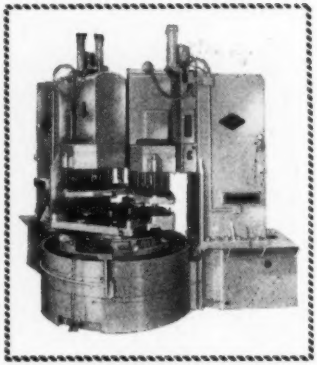
ALFRED HERBERT LTD., COVENTRY – FACTORED DIVISION, RED LANE WORKS



DUPLEX MILLING MACHINE fitted with travelling table and U.H.3 Unit Heads. Air operated Quill retraction.

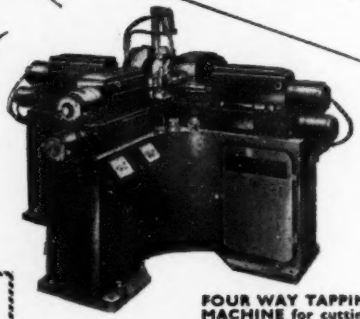
DOUBLE-ENDED BILLET DRILLING MACHINE embodying two **BROOKE** U.H.3 Unit Heads.



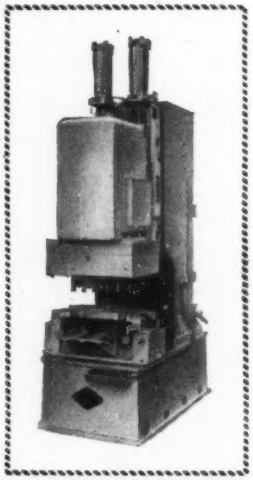


ROTARY INDEXING MACHINE for multi-drilling and tapping with two vertically mounted **BROOKE** U.H.3 Unit Heads.

A.M.T. designed and built!
FROM STANDARD UNIT PARTS



FOUR WAY TAPPING MACHINE for cutting four threads simultaneously.



VERTICAL MULTI-DRILLING MACHINE fitted with **BROOKE** U.H.4 Unit Head.

ROTARY INDEXING MACHINES for multi-drilling, tapping, facing and boring operations.

These are examples of A.M.T. Machines recently supplied. Similar set-ups for any number and type of operation can be designed and built from Standard Parts equipment. Enquiries are invited and our Design Engineers are available at any time to discuss your own production problems.

A.M.T. (B'ham) LTD., BOURNBROOK, BIRMINGHAM 29
Telephone : Selly Oak 1128/9/20 *Telegrams : "Amtold, B'ham"*

PNEUTOMATION

Registered Trade Mark

at work This Auto Boring machine at Messrs. S. & H. McLaren Ltd. of Leeds is another example of how Pneutomation is increasing output and cutting costs.

LANG PNEUMATIC CONTROL GEAR
entirely non-corrodible

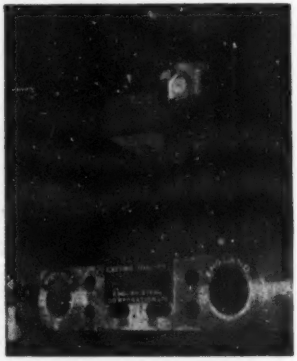
Plan with
LANG PNEUMATIC LTD
VICTORY WORKS BIRMINGHAM ROAD WOLVERHAMPTON Tel 3522[illegible]

P.104

LARGE LOAD

. . . and the Belleville makes it possible . . . !

The largest capacity spring balance in the world. This instrument was made to weigh giant steel castings and is graduated up to 200 tons with 1 ton sub-divisions. It is approved by the Board of Trade for "Trade" purposes, where the requirement is that the machine must be accurate to within a quarter of its smallest sub-division.
Two Belleville washers, in this instance opposed to each other, supply the spring resistant. Their total movement under full load of 200 tons is never more than $\frac{1}{4}$ of an inch.



SALTER . . .

. . . always a spring ahead!

★ When resistance to load or thrust is beyond the capacity of helical springs,

★ When take-up of shock or sustained load must be restricted to very slight movement,

★ When many tons of dead load must be sustained plus intermittent shock or live load . . .

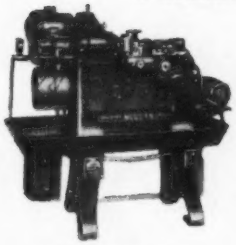
. . . it's time to call in **SALTER** technicians!

GEO. SALTER & CO. LTD., WEST BROMWICH, ENGLAND . ESTABLISHED 1760

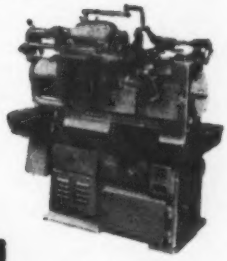
Agents for Zeuna-Starker Unit Millers, Smart & Brown Lathes and Toggle Presses

Write for further details and literature

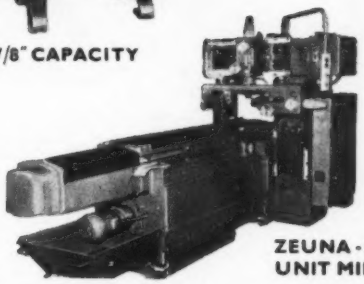
3 OPERATION AUTOMATICS



7/8" CAPACITY



1 1/4" CAPACITY



ZEUNA-STARKER M.V.A. UNIT MILLING MACHINE

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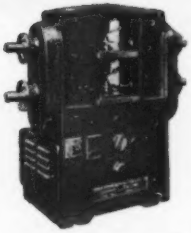
MACHINE TOOLS LIMITED

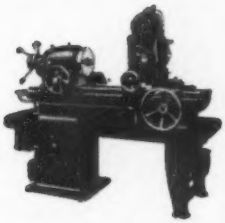
GOSFORD STREET · COVENTRY

Telephone 2132-6 Cables: Modern Coventry

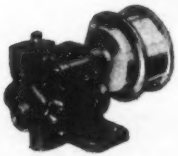
No. 2EE HOBROUGH SURFACE GRINDER



3 WAY TAPPING MACHINE

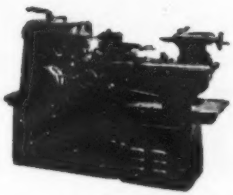


THREAD MILLER

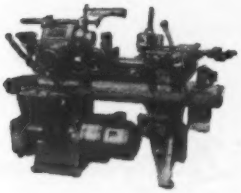


SIPHON PUMP

MODERN



OIL GROOVER



2C CAPSTAN LATHE

Rainbow 1399

NOW! THE FIRST REALLY OIL-RESISTANT BELT IN THE WORLD

Dixylon

SUPLEX THE IDEAL BELT FOR THE MACHINE TOOL INDUSTRY

DIXYLON SUPLEX—the latest addition to the Dixylon range of plastic beltings.

DIXYLON SUPLEX—the Dixylon belt with the special oil resistant properties.

DIXYLON SUPLEX—retains its coefficient of friction under conditions of running oil and possesses anti-static properties.

DIXYLON SUPLEX——retains all the characteristics of standard Dixylon—great strength light weight, resistance to heat, stretch and adverse conditions—is just as suitable for high speeds up to 10,000 f.p.m., very small pulleys, short centres, etc.

DIXYLON SUPLEX—is made endless with simple tools in 15 minutes either at the factory or by you on site.

DIXYLON SUPLEX—is made in weights and thicknesses to suit your drive.

Designed specifically for the machine tool industry, Dixylon Suplex is an outstanding plastic belt that really resists oil.

THE MOST MODERN DEVELOPMENT IN POWER TRANSMISSION

Dixylon **SUPLEX BELTING IS OF COURSE A PRODUCT OF** **R. & J. DICK, Ltd.**

THE NAME THAT MEANS DEVELOPMENT IN POWER TRANSMISSION

Branches: Glasgow, London, Birmingham, Bristol, Manchester, Leeds, Newcastle, Dundee, Belfast, Dublin, Amsterdam, and Vienna.
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LONDON BRICK COMPANY LIMITED

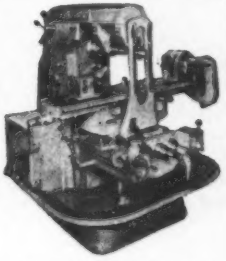
use **RICHMOND** MACHINES

A RICHMOND S. R. 2 Radial Drilling Machine operating in the workshops of this famous brickmaking firm.

THE 600 GROUP OF COMPANIES

SEND FOR LEAFLETS giving specifications and full technical information on RICHMOND DRILLING and MILLING MACHINES.

RICHMOND MILLING AND DRILLING MACHINES

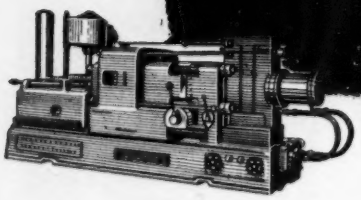


No. 4 UNIVERSAL MILLING MACHINE

MIDGLEY & SUTCLIFFE LTD. HILLIDGE WORKS, LEEDS 10. **Telephone: Leeds 76032/3**

When answering advertisements kindly mention MACHINERY.

HARPER CASTINGS for our melting pots are highly successful say E. M. B. CO. LTD. makers of die casting machines



Harper quality covers Grey Iron, Spheroidal Graphite Iron (Mond Nickel Licence) and Meehanite castings.
Also metal pressings, machining, enamelling and other finishes and sub-assembly work.

The melting pots for the E.M.B. No. 14 Die Caster are made from Harper Meehanite Castings chosen by E.M.B. because (1) They withstand thermal and mechanical shock. (2) Have good machining qualities. (3) Are dimensionally accurate and of uniform quality (4) Give vastly improved life.
Since they changed to Harper Meehanite Castings E.M.B. have had no trouble with their furnace pots on machines injecting metal between 8 and 25 shots per minute ... "These remarkable figures would not be possible without Harper Meehanite Castings," say the makers.

HARPER CASTINGS

CASTINGS WITH THE HARPER SKIN

JOHN HARPER & CO. LTD. JOHN HARPER (MEEHANITE) **LTD.**
ALBION WORKS Phone: WILLENHALL 124 (5 lines) Grams: HARPERS, WILLENHALL **WILLENHALL**

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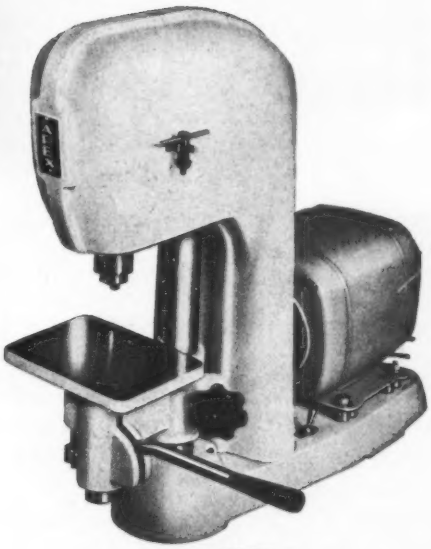
H 649

APEX

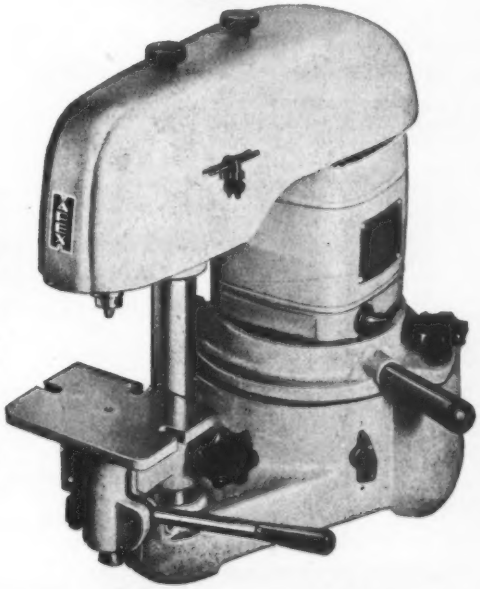
SENSITIVE TAPPING MACHINE

CAPACITY 14 B.A. to ¼in. Whit. in brass. 14 B.A. to 2 B.A. in steel.

The design of this machine is based on many years' experience of tapping small holes, combining speed of operation with maximum tap life. Simplicity and rigidity of construction ensure trouble-free working. The spindle is light, carrying no clutches or other mechanism and being rotated by a friction cone drive.



Both these machines have special quick-action table movement for fast production, plus robust construction. They are supplied complete with ¼ h.p. motor.



Junior SENSITIVE DRILLING MACHINE

¼" CAPACITY SPEEDS UP TO 10,000 R.P.M.

This robustly constructed machine has been specially designed to produce accurate holes from 0·010in. to 0·250in. diameter, meeting the exacting requirements of the horological and instrument trades; it is equally suitable, however, for the general engineering workshop where accuracy and speed are the main considerations.

MANUFACTURED SOLELY BY

ENGINEERING PRODUCTS LIMITED

GLENBROOK WORKS, LITTLERS CLOSE, MERTON ABBEY, LONDON, S.W.19, ENGLAND
Phone: LIBERTY 1085—1086.
Grams: OLDAKGAUGE, SOUPHONE, LONDON. Cablegrams: OLDAKGAUGE, LONDON.
Codes: MARCONI, A.B.C. 6th EDN. BENTLEYS.

INTRODUCING a NEW 'ST' Threading Machine

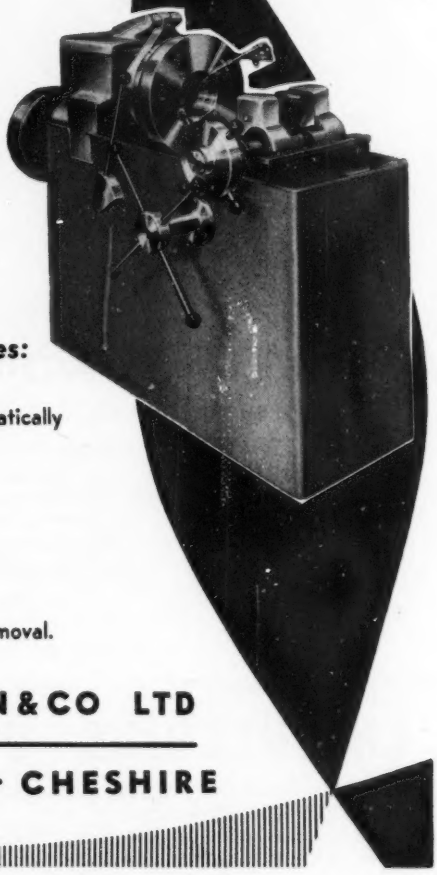
UNIQUE TAPER THREADING

½"—4" TUBE. ½"—2" BOLT CAPACITY

LEVER RELEASE MECHANISM

SIMPLE TO OPERATE & MAINTAIN

LOW INITIAL COST



NEW 'C' Series Exclusive Features:

- ★ Totally enclosed headstock automatically lubricated.
- ★ Hammer action vice.
- ★ Replacement steel head.
- ★ Lighter traverse mechanism.
- ★ Large cutting tray with handy removal.

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MAIDEN & CO LTD

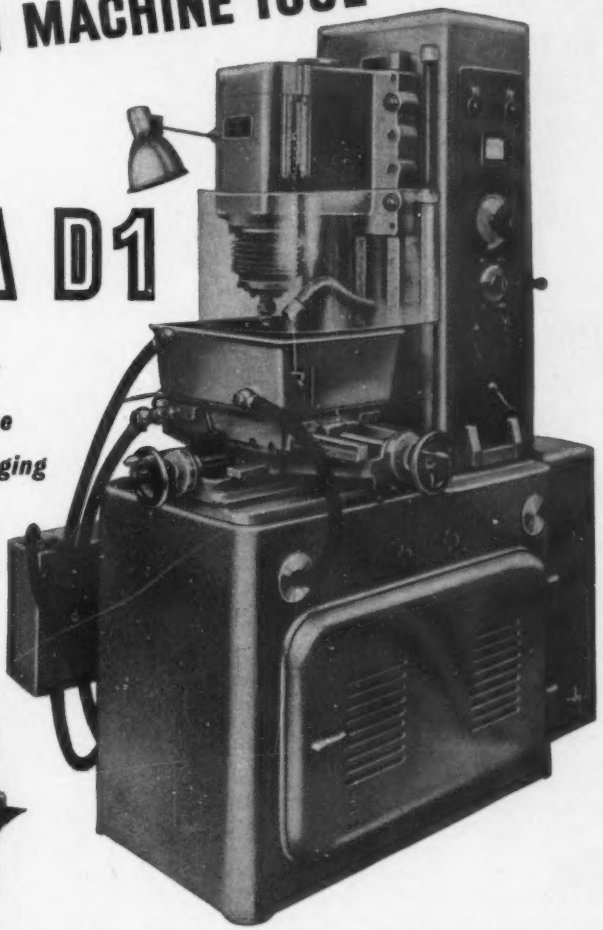
HYDE · CHESHIRE

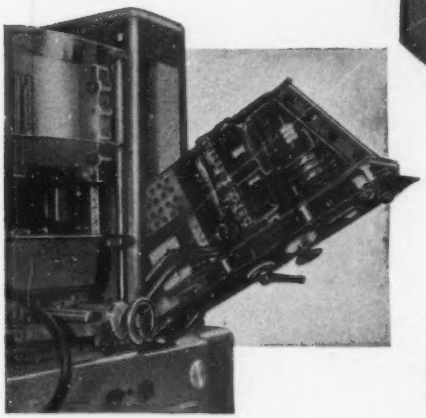
SM/MA 3572

THE *FIRST* SPARK ERODER BUILT AS A PRECISION MACHINE TOOL

ELERODA D1

Today's answer to the making of Drawing and Piercing Dies and the making and reconditioning of Forging and Stamping Dies—Machines the "Unworkable" metals.





A precision Swiss built machine which is today's answer to the machining by electro erosion of metals of any hardness such as hardened steel, tungsten carbide and nimonic without causing distortion of work or alteration of mechanical or physical properties of machined surfaces. The patented electrical circuit combined with the sensitive electro hydraulic servo-mechanism ensures speed of operation and high precision. Six different surface finishes from coarse for roughing to the finest finish are obtainable. 20 power settings. Automatic depth cutout.

ROCKWELL
MACHINE TOOL CO. LTD.

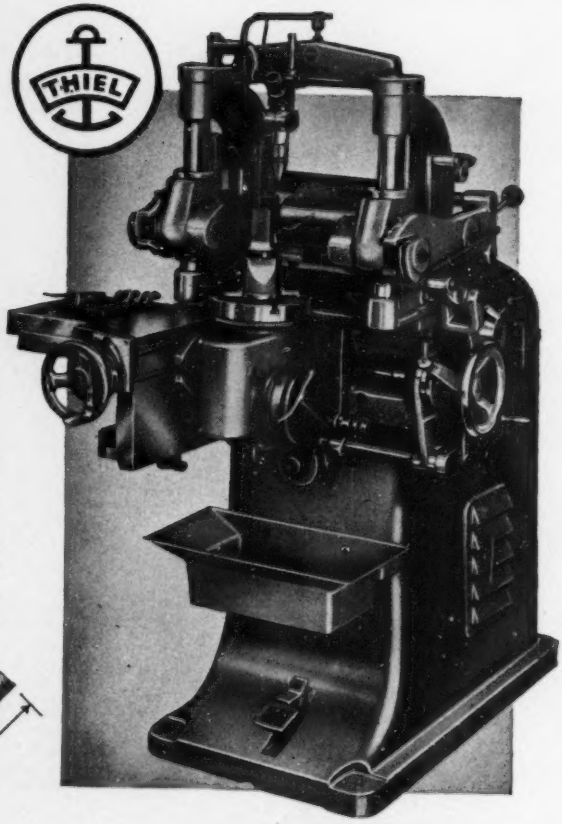
WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

ALSO AT BIRMINGHAM—TEL: SPRINGFIELD 1134/5 • STOCKPORT—TEL: STOCKPORT 5241 • GLASGOW—TEL: MERRYLEE 2822

EL

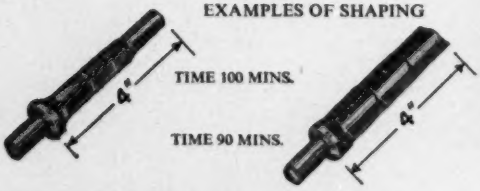
Spark Erosion
ELECTRODE
MAKING
now Speedy
Accurate-Simple

THIEL 132
PUNCH SHAPING MACHINE



Easily produces stepped electrodes, thus enabling one electrode to be used for both roughing and finishing.
Machining of intricate shapes made easy.
Punch and electrode can be made together from one piece of steel, or if copper electrode required, in one operation by previously soldering the copper part on to the steel part.
Machine is capable of taking heavy cuts up to 1/8" on steel, yet fine finishing cuts of .0005".
Can be used for punches with or without base radii.

EXAMPLES OF SHAPING



ROCKWELL
MACHINE TOOL CO. LTD.

for further particulars write or telephone TODAY

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ALSO AT BIRMINGHAM—TEL: SPRINGFIELD 1134/5 • STOCKPORT—TEL: STOCKPORT 5241 • GLASGOW—TEL: MERRYLEE 2822

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Simple

Reliable!

The *new* LASCO High-Speed Hammer with short stroke and extra heavy tup, specially suitable for multi-impression work. With single stroke or continuous operation control.

✻ *Convert your old board, belt, or steam hammer by fitting a modern LASCO driving head.*

Lasco **HIGH-SPEED ELECTRO-HYDRAULIC DROP-HAMMER** Type KH

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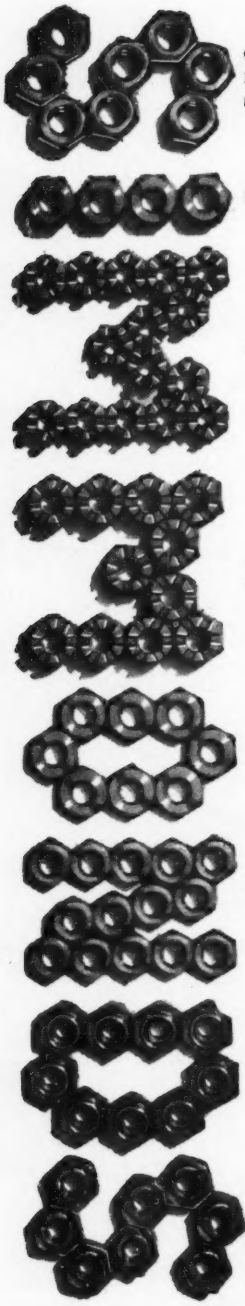
Telephone: ABBEY 3338 Telegrams: POWAFORGE, SOWEST, LONDON Cables: POWAFORGE, LONDON

Rainbow 1697



COLD FORMED DOUBLE CHAMFERED STEEL NUTS

FULL NUTS

SLOTTED NUTS

ROUND TOP CASTLE NUTS

THIN LOCK NUTS

SPECIAL NUTS

ROOT NUTS

SPECIAL COLD FORMED NUTS

A BIG NAME IN NUTS!

We're not going to *say* we make the best nuts in the world (though that doesn't stop us thinking so, does it?) but we do suggest that when you're buying Bar Turned or Cold Formed Nuts it's worth remembering our name. We manufacture large quantities in a wide range of sizes, steels and finishes—and if you want a special nut or turned part for a special job, we can supply it.

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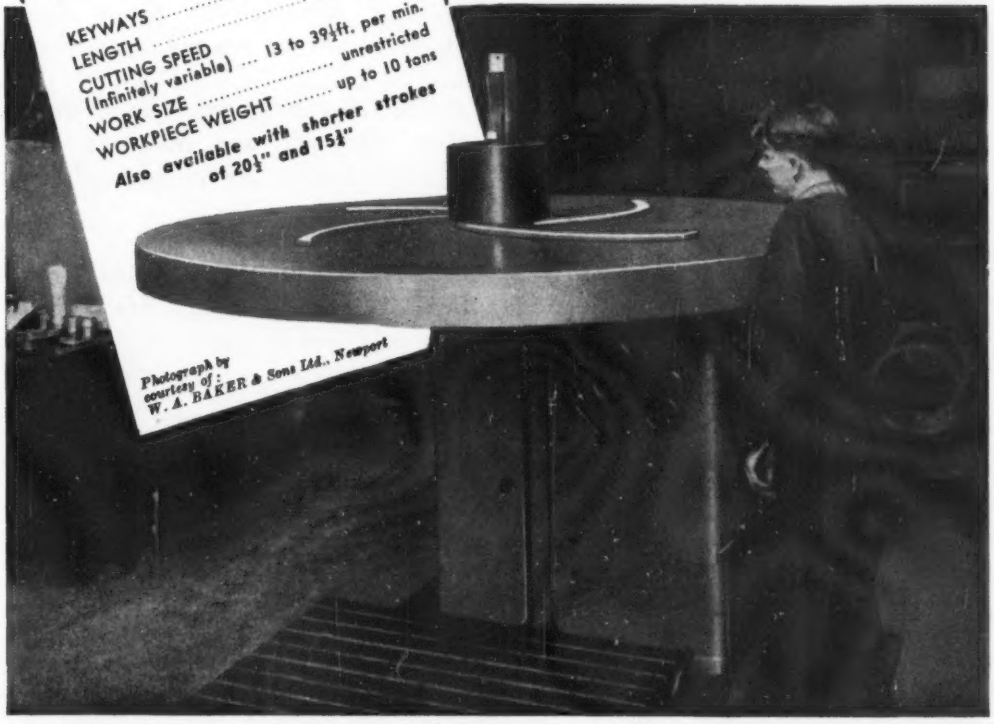
INFINITELY VARIABLE CUTTING SPEEDS ENSURE MAXIMUM PERFORMANCE—REGARDLESS OF SIZE

For the rapid and economical cutting of keyways and splines, these machines are unsurpassed. No marking out of parts is required, and several components may be machined at one pass. Tooling is very simple, and provision is made for the cutting of taper keyways and splines. Only a small space is required for the machine, which can carry up to 10 tons in weight, of almost any size.

MODEL NZH 70 as Illustrated

CAPACITY	
KEYWAYS	⅛" to 2½" wide
LENGTH	up to 24½in.
CUTTING SPEED (Infinitely variable)	13 to 39½ft. per min.
WORK SIZE	unrestricted
WORKPIECE WEIGHT	up to 10 tons

Also available with shorter strokes of 20½" and 15½"



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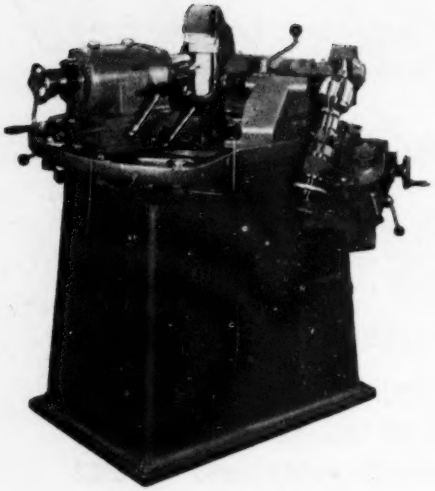

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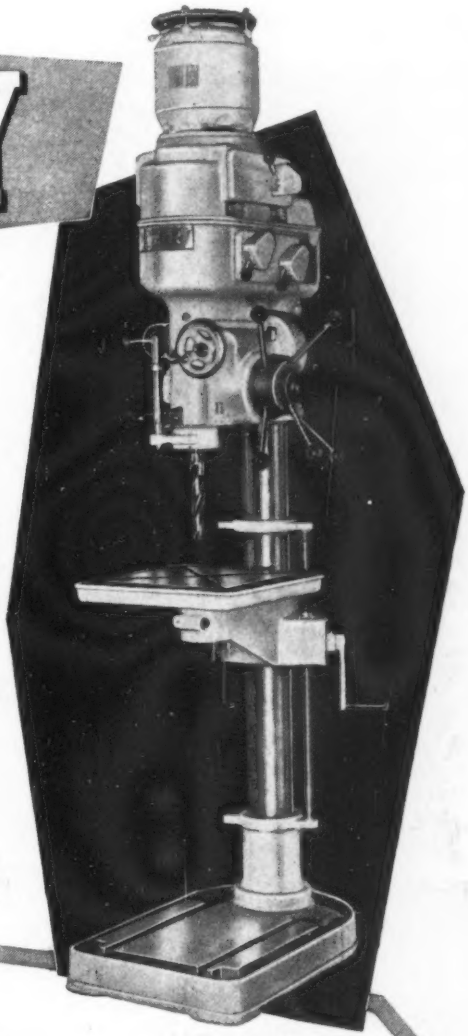

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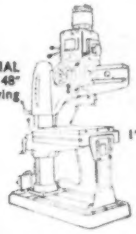

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FACING AND BORING AT ALFRED HERBERT LTD, COVENTRY

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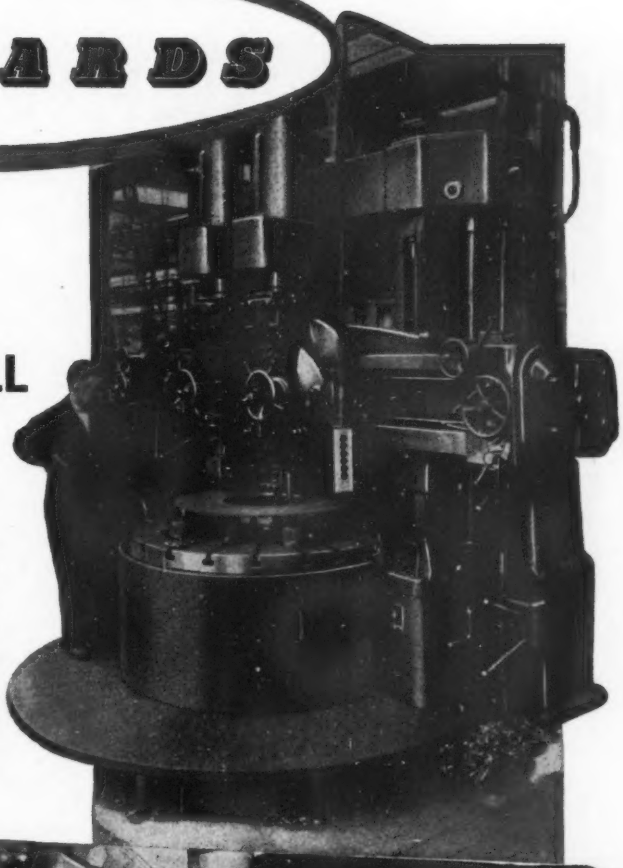

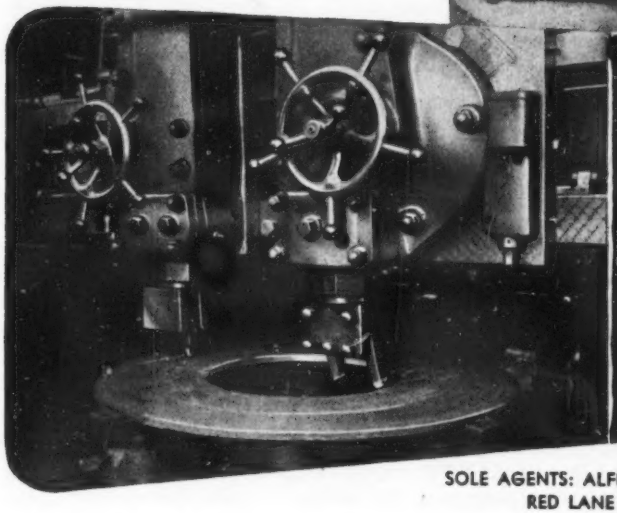

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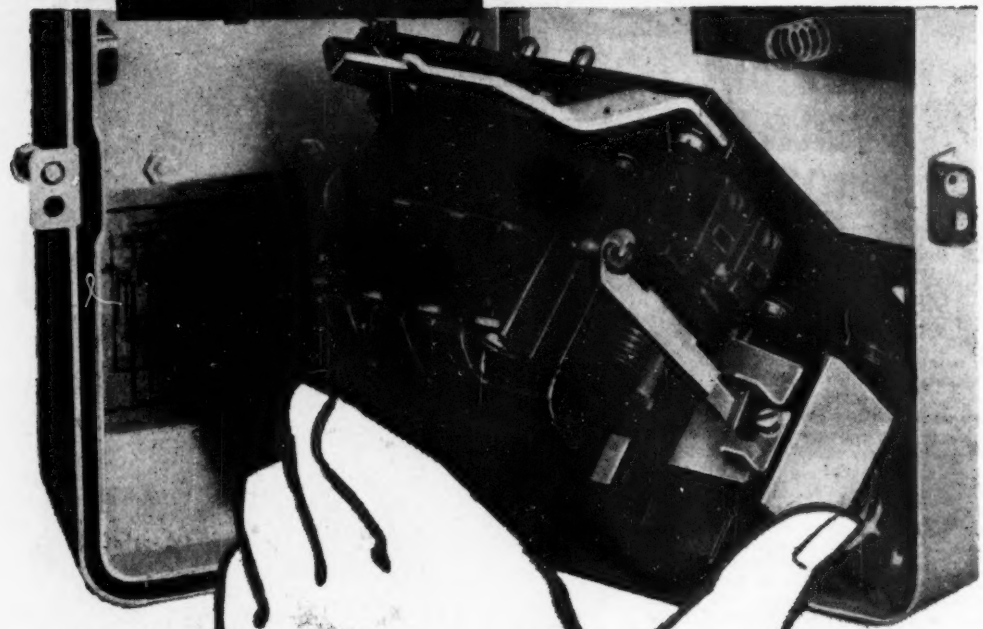
TYPE 616

THE BROOKHIRST PLUG-IN STARTER



To remove or replace the interior unit of the BROOKHIRST 616 STARTER is a matter of seconds . . .

. . . the front-connected block contactor and overload relay are mounted on a moulded panel having plug-in isolating contacts secured to its underside. Withdrawal entails no more than releasing a retaining clip; no tools required; no trailing cables to disconnect. The 616 starter is ideal for applications demanding continuous running. Suitable for 3-phase squirrel cage motors up to 7½ H.P. 550 V. Full details in Leaflet 1800.

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SLIDING HEAD AUTOMATIC

MODEL R.16

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TORNOS Automatics are available in the following sizes:-

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Max Dia Bar	5/32	9/32	15/32	5/8	1 3/32

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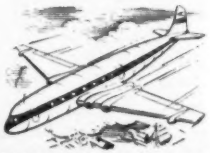
On Hospital equipment using medical gases, or on industrial plant where compressed air, coal gas or calor gas is used SPOT-LEAK is invaluable for installation and checking tests as well as for the detection of suspected leaks on established systems.



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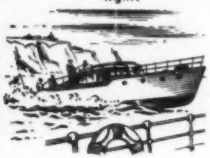
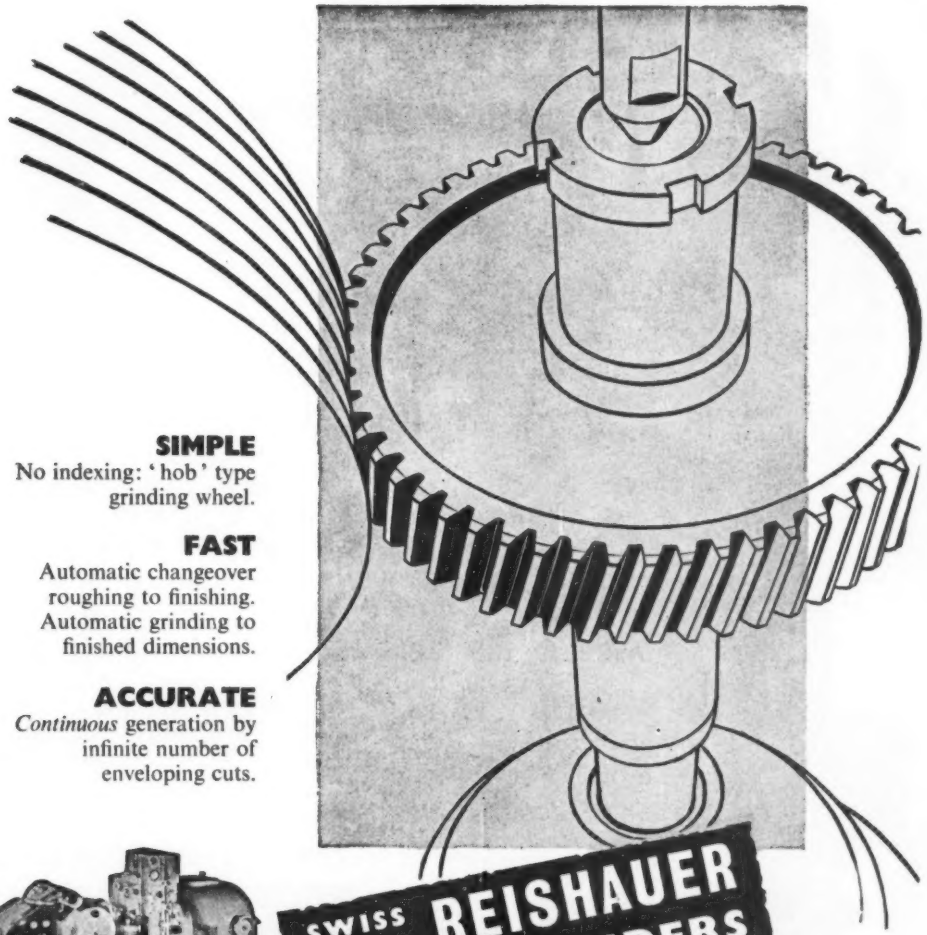
SPOT-LEAK finds the leaks in pipes, valves, joints and radiators of central heating or coal gas plant in the home. It is invaluable for testing calor gas lighting or heating systems in Caravans or Boats where space is limited and headroom small with the necessity to work by flashlight.





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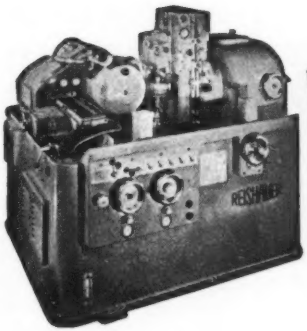

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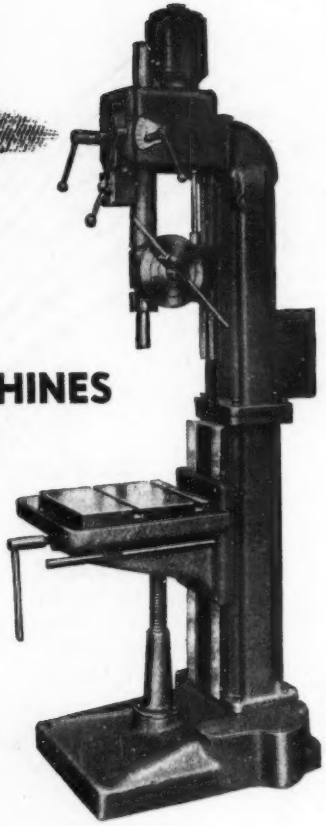
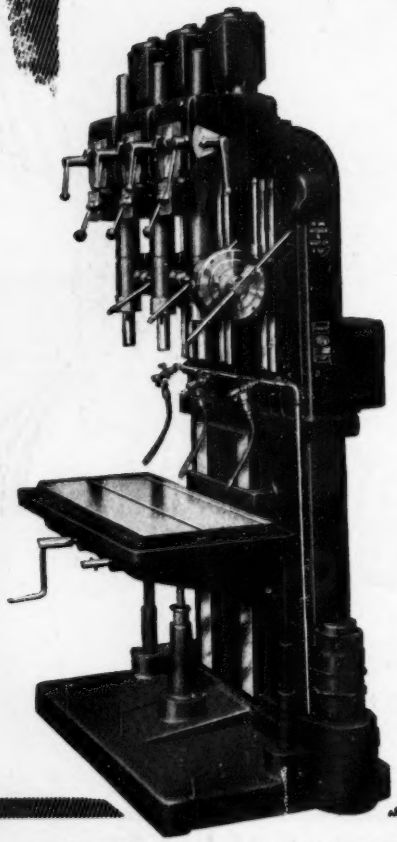
DRILLING MACHINES
TYPE V 20





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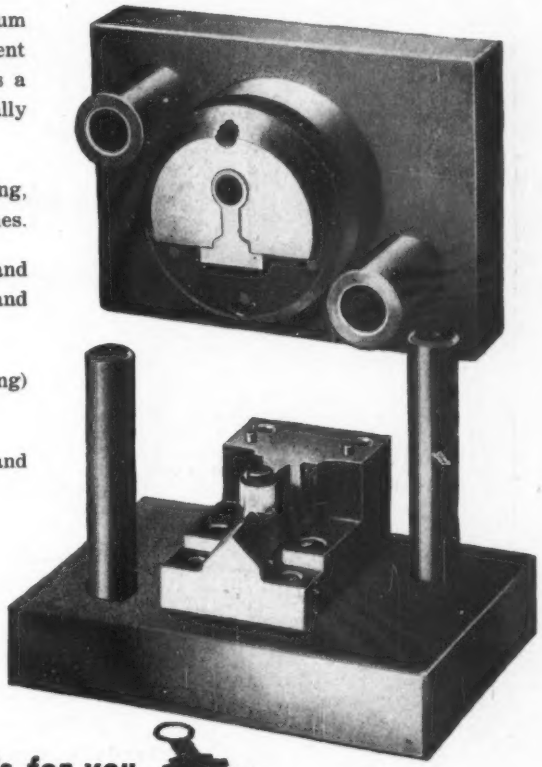

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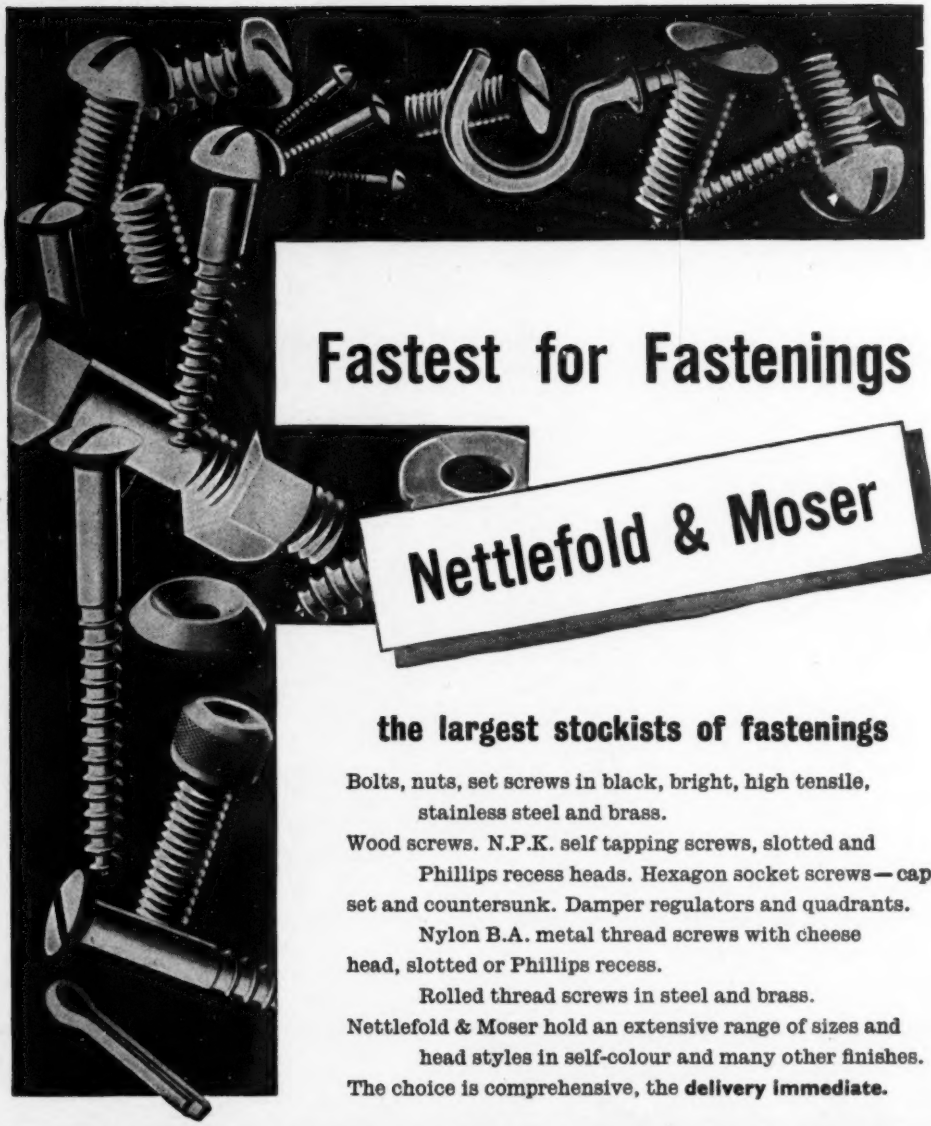

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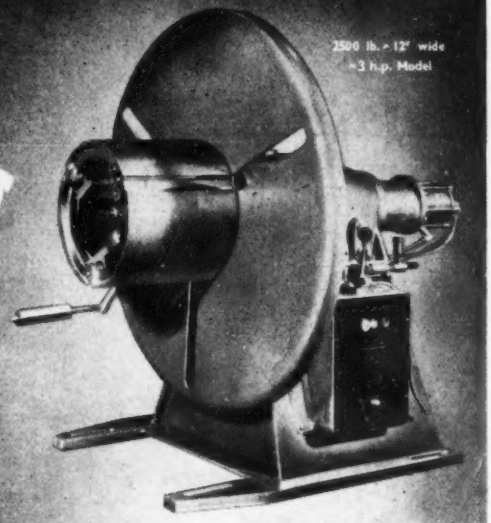
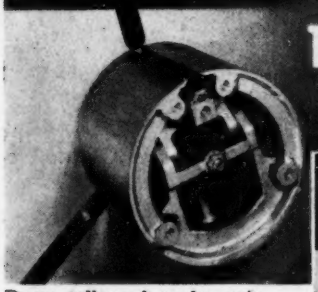
Strip Rewinding

easy as one-two-three

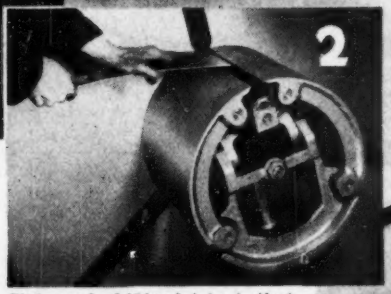




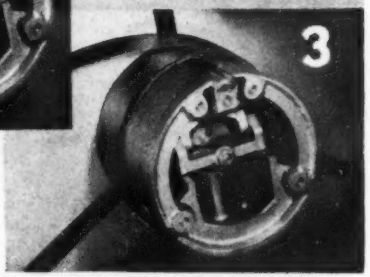
Drum collapsed, wedge grip withdrawn.

with the new

HUMPHRIS COILING DRUMS



Strip pushed into slot (note that entry can be made in either direction).



Air (or hydraulic) valve actuated to expand the drum and wedge the leading tongue of strip. Rewinding can commence.

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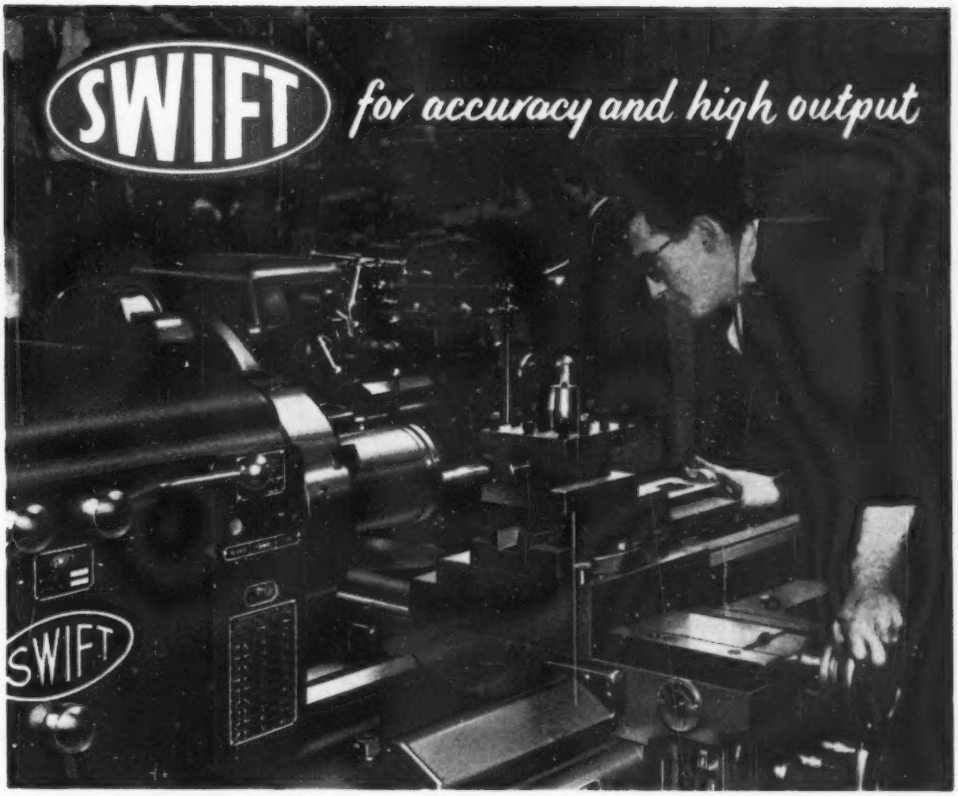

The 28in. swing Swift lathe shown above is installed in the research centre of Ruston & Hornsby Ltd., Lincoln, England. It is set up for boring cylinder liners for diesel engines in the 50-150 h.p. range.

The Swift type 'B' lathe is made in the two capacities listed opposite. These lathes are ideal for work where versatility and accuracy are a first necessity and are also extremely popular for high-output production, being capable of utilising carbide tooling to the utmost advantage. A standard nine-feed box and change wheels or an alternative Norton box giving 54 rates of feed can be supplied.

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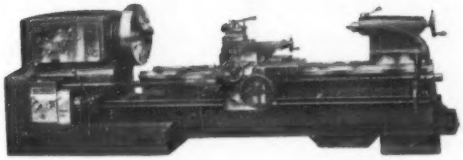
HALIFAX · ENGLAND



GENERAL SPECIFICATION		
Type	11B	14B
Swing over bed	22½in.	28in.
Admits between centres	5ft. 9in.	7ft. 0in.
Swings over saddle	14in.	19in.
Swings in gap	33in. × 12in.	40in. × 14in.
H.P. recommended	12½	15
18 spindle speeds	9-420 r.p.m., 13·5-630 r.p.m., 17-800 r.p.m.	

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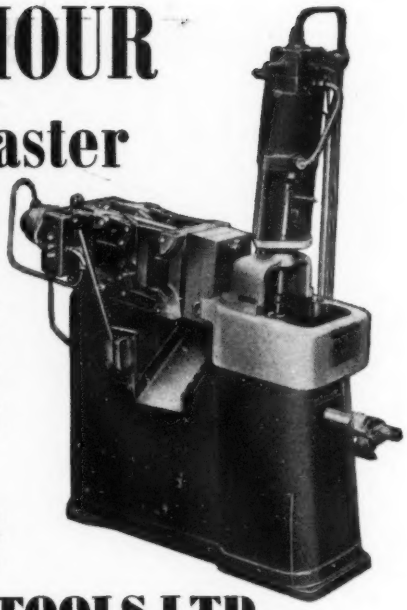
with the IMP/96 die caster



Depending on weight per shot, this air-operated impact die caster will make *up to 800 shots per hour*. Production is thereby increased and larger machines in the foundry made available for dealing with the bigger articles.

Moreover, castings have greater uniformity and precision — thanks to the new-type injection cylinder and air-operated die unit, which exert higher pressure on the molten metal. Production of the larger, heavier castings is accordingly simplified. The IMP/96 operates on a standard 80 p.s.i. airline and consumes as little as ·55 cu. ft. of free air per operating cycle. Write now for full details.

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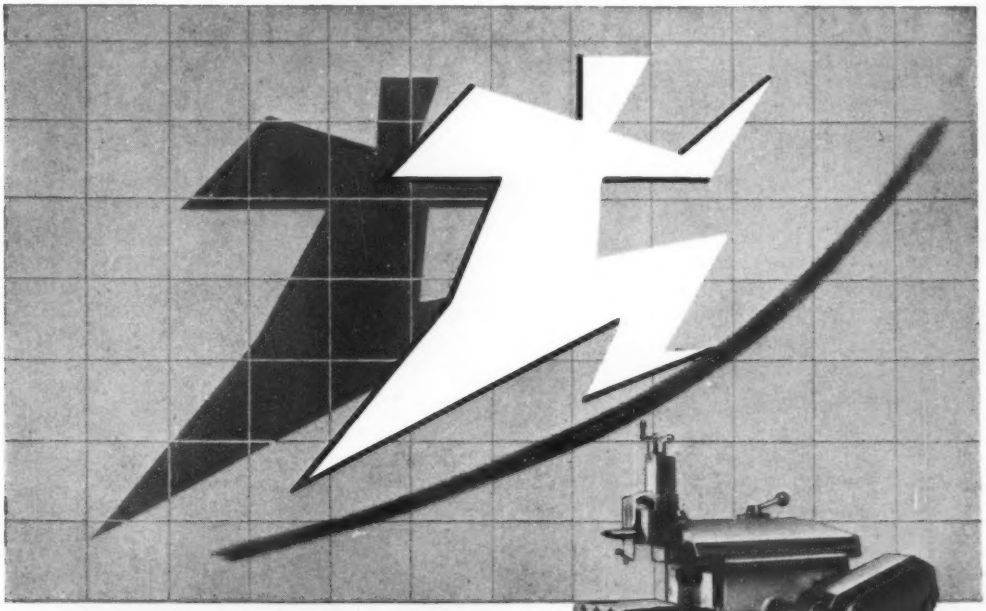

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- Tool head swivels through 90°
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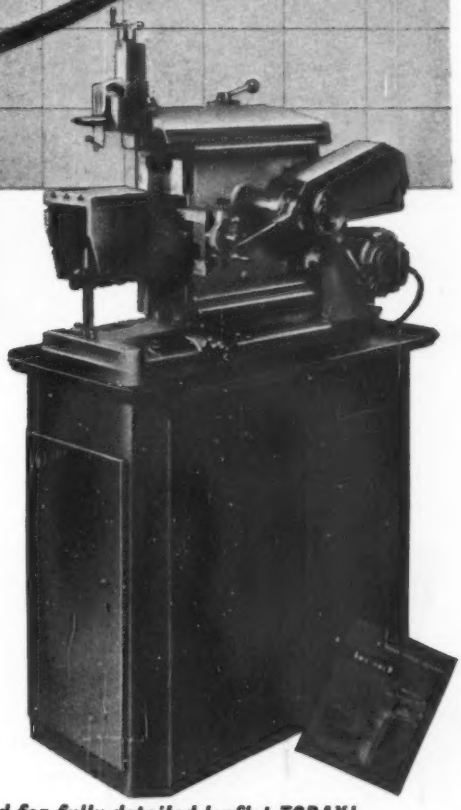
- ½ h.p. motor with Vee drive transmission
- The cabinet base provides storage accommodation for tools and equipment.



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HECKMONDWIKE, YORKSHIRE

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Buildings are going up quicker now *

*

Yes, the super capacity builders' elevator shown here is playing a vital part in helping contractors to speed up construction work, thus saving time and reducing labour costs.

M. B. Wild and Company Ltd., are the manufacturers of this super capacity elevator, which incorporates Perry long pitch conveyor chain with K2 attachments to which the carriers are bolted.

PERRY **LONG PITCH CONVEYOR CHAINS**

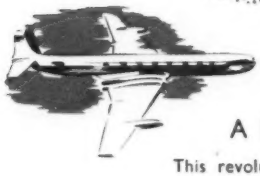
are available from stock. So are Perry Single, Duplex, Triplex and Quadrupulex Roller Chains, Bush and Balance Chains, the new series of MR Chains, Attachments Plates and Chain Drives. Please write for further particulars and a copy of the new and fully illustrated Perry Industrial Chain Handbook

PERRY CHAIN COMPANY LIMITED

TYSELEY, BIRMINGHAM 1 *(A Division of the Perry Group)*

P1/18

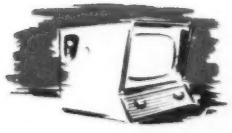
the 12 INCH MICROBALL HEIGHT GAUGE for every industry



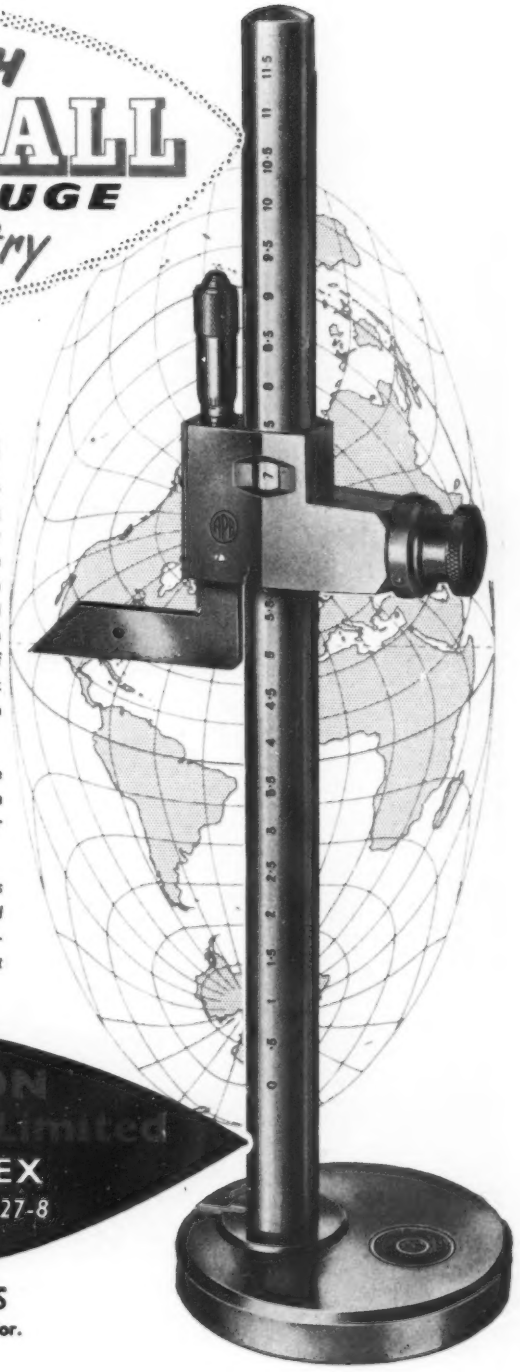
A NEW APPROACH

This revolutionary height gauge has been designed to satisfy the exacting standards demanded by contemporary times and represents an answer to the ever-increasing difficulties arising from intensive production and automation with often only semi-skilled staff available. The instrument is available graduated in English or metric measure.

The low price brings it within the range of not only the small workshop but the individual toolmaker, inspector machinist, etc.



Send now for full details of this new patented height gauge that you cannot afford to be without



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Telephone: HORSHAM 2227-8

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British and Foreign Patents applied for.

It's no good looking at me!...

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It may be something of a dog's life humping steel about, but it is our business . . . We have over 5,000 tons of Bright Drawn and Hot Rolled Carbon and Alloy Steel Bars to all the main E.N. Specifications to meet your requirements. Our premises are specially designed for the storage of steel and the latest handling equipment ensures that material is delivered in "Mint" condition. Yes, when it's a question of steel it pays to ask "Mr. Mac" first.

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Macready's Metal Co. Ltd.

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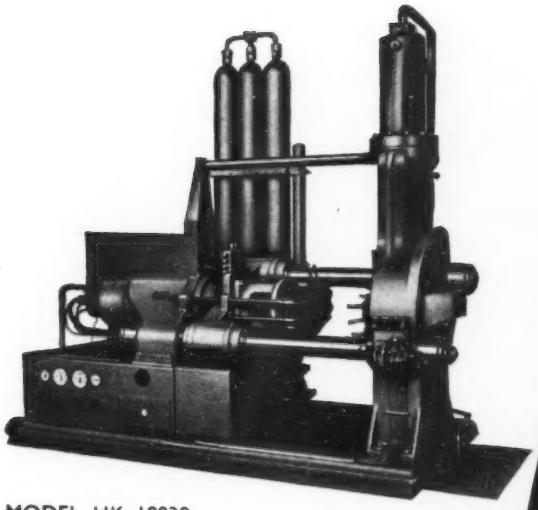
Telephone: TERminus 7060 (20 lines). Telegrams: Usaspead, London, Telex. Telex No. 22788



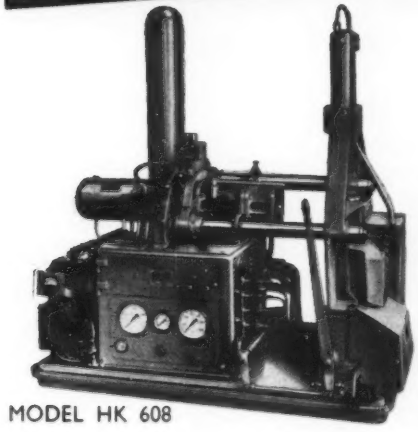
MODEL HK 18030

Hahn & Kolb Pressure Die-Casting plant is recommended for a wide variety of applications, including transport, electrical trades, optical and photographic industries, building, hardware and household trades, toy and model industry, office machinery, clockwork engineering.

MODEL 18030 — a self contained machine consisting of one horizontal and one vertical hydraulic pressure unit, accommodated on a welded steel frame. Pressure accumulators are included in the construction.

for Pressure Die-casting — Equipment...

specify HK



MODEL HK 608

The results of many years' experience are built into these fine machines.

Hahn & Kolb of Stuttgart are specialists in the production of die-casting machinery and plastic moulding plant. Here in this country our specialists are available to advise and assist you both before and after sales.

MODEL HK 608 — a self contained machine consisting of horizontal and vertical pressure units built to the high standard of construction uniform throughout the range.

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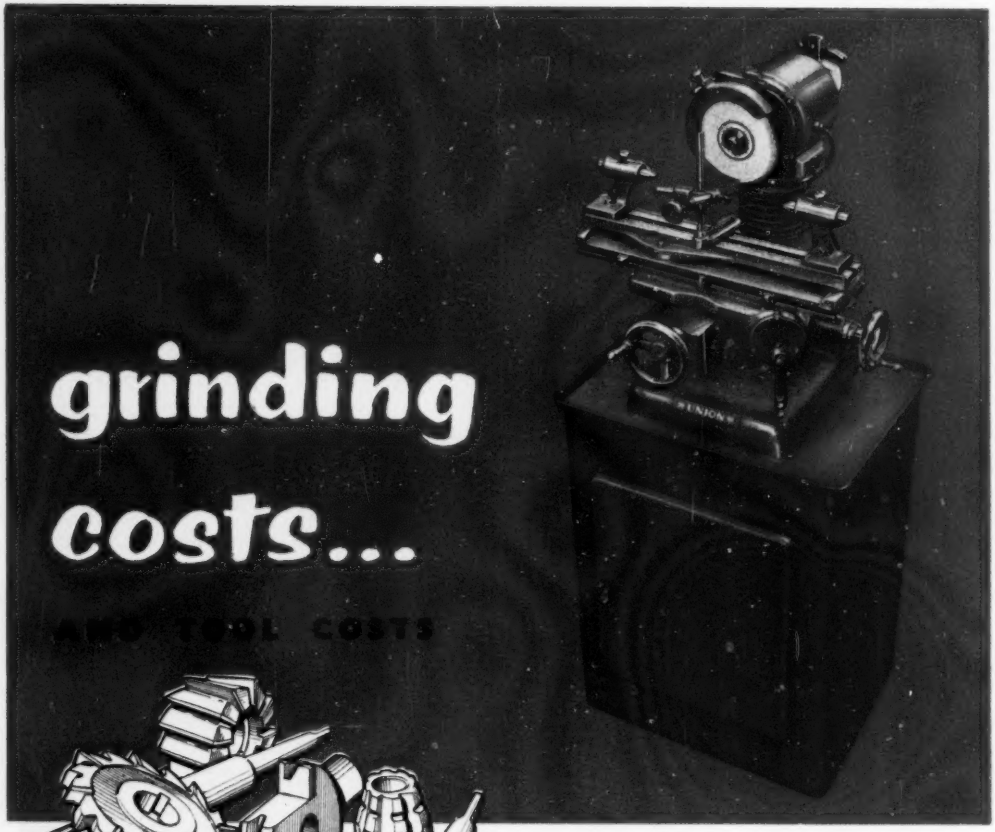

Prolonged tool and cutter life, and better quality finishing are yours with the Union Tool and Cutter Grinder.

UNION
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PAYS OFF IN TOOL SAVINGS

£157·15

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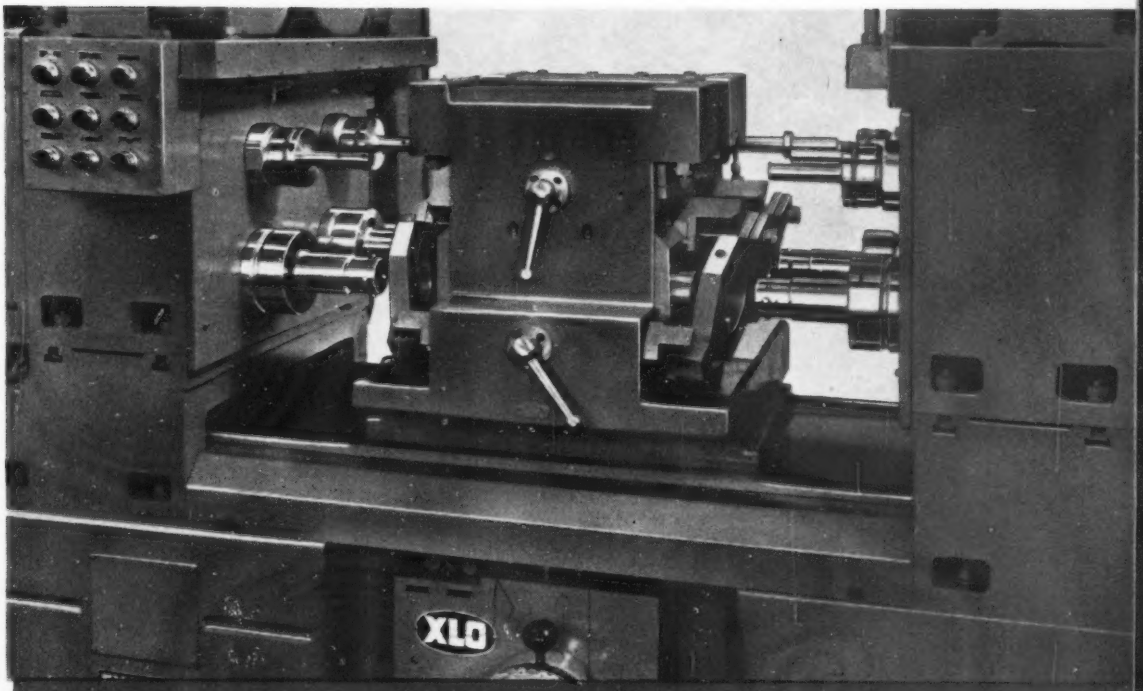
T. S. HARRISON & SONS LIMITED HECKMONDWIKE YORKSHIRE

✳ BORING CONNECTING RODS . . .



*220 per hour!

This is a typical EX-CELL-O set-up in a well-known automobile factory, where EX-CELL-O machines have proved their ability to reduce costs and improve finish on a wide variety of work. Both the large and small ends of the rods are machined and the production rate is 220 pieces per hour. We invite you to investigate the cost reducing possibilities of EX-CELL-O machines for your own work. No obligation.

EX-CELL-O

STYLE B4C SERIES
PRECISION BORING
MACHINE

EX-CELL-O CORPORATION (MACHINE TOOLS) LIMITED
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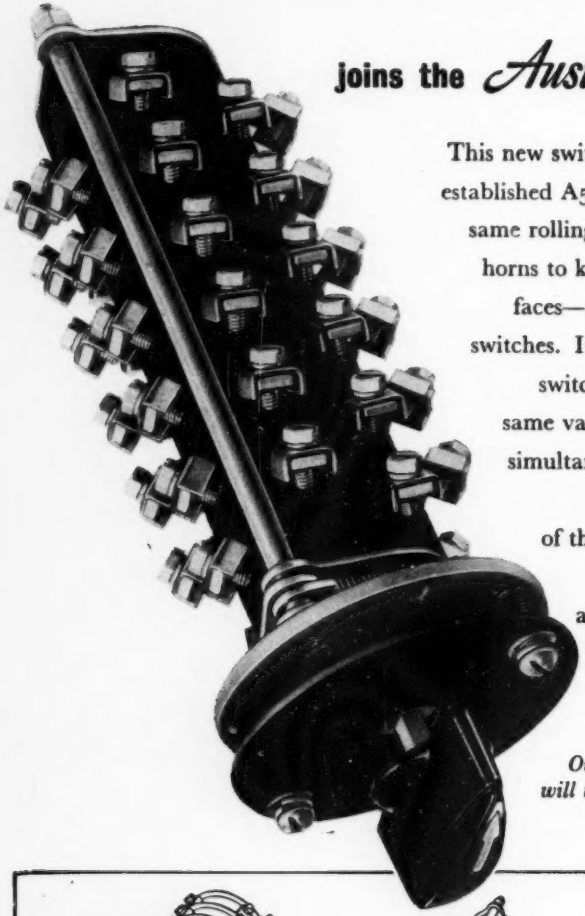
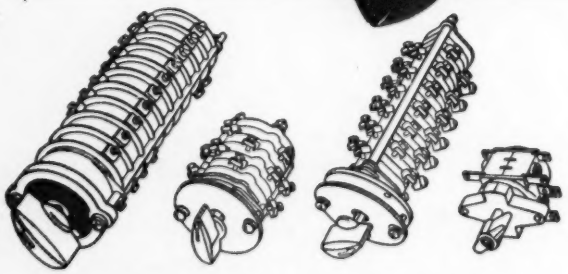
Now the A15—



joins the *Austinlite* rotary switches

This new switch is identical in principle to the well established A50 and A30 rotary switches. It has the same rolling, self-cleaning contacts with extended horns to keep any arcing away from the contact faces—a feature exclusive to Austinlite rotary switches. It has a similarly powerful and positive switch mechanism, and can be built in the same variety of forms to switch in sequence or simultaneously very large numbers of circuits. It is extremely compact, the smallest of the Austinlite multi-cell rotary switches. It bridges the gap between the A30 and the little single-cell 10-amp switch. Delivery, on standard applications, can now be made in four weeks.

Our brochure "SIMPLIFIED SWITCHING" will tell you more about the advantages of Austinlite Rotary Switches. May we send you a copy?



The four Austinlite Rotary Switches—A50, A30, A15 and A10

Austinlite

ROTARY SWITCHES

tailor-made by

STONE-CHANCE LTD.

(Makers of Sump Pumps and Stone-Chance lighthouses). Crawley, Sussex

GLEASON No. 16 PINION QUENCHING MACHINE

for holding and quenching heated pinions
for hardening without distortion
three individual units each of which may be operated separately

- *completely automatic*
- *automatic straightening*
- *controlled force quench*
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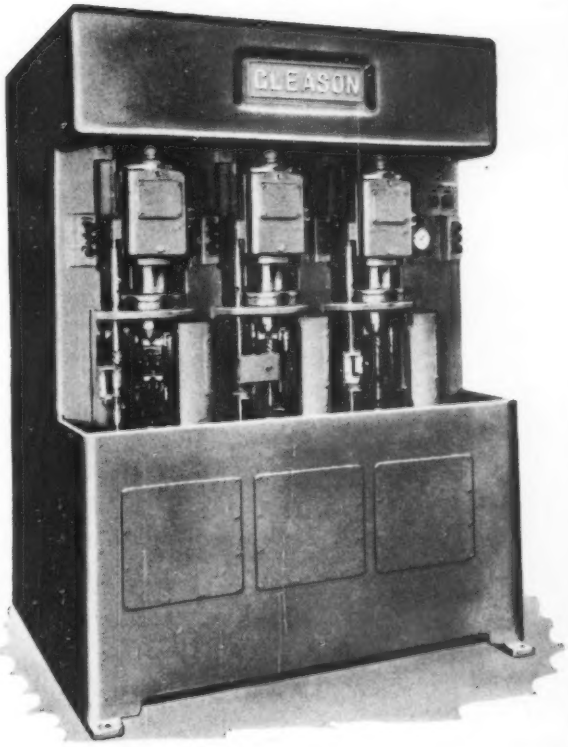

BUCK & HICKMAN LTD

Head Office—Whitechapel Rd., London, E.1
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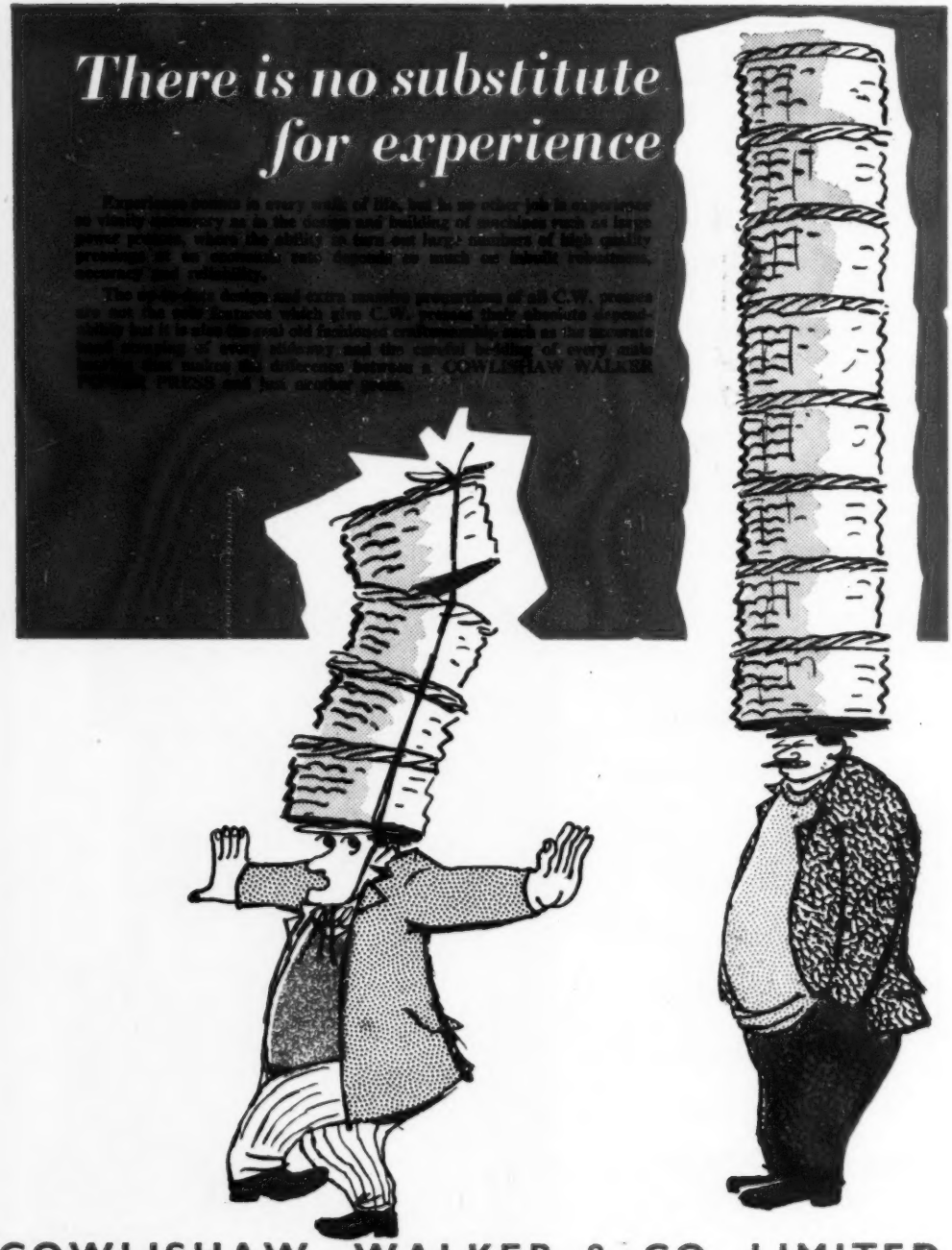
There is no substitute for experience

Experience counts in every walk of life, but in no other job is experience so vitally necessary as in the design and building of machines such as large power presses, where the ability to turn out large numbers of high quality pressings at an economic rate depends as much on inbuilt robustness, accuracy and reliability.

The up-to-date design and extra searching preparations of all C.W. presses are not the only features which give C.W. presses their absolute dependability but it is also the avoidance of cost-cutting such as the accurate hand scraping of every slideway and the careful building of every main moving part, which makes the difference between a COWLISHAW WALKER PRESSES and just another press.

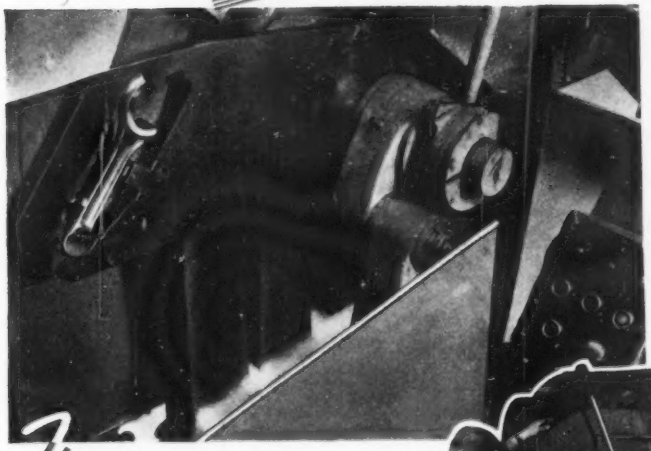


COWLISHAW, WALKER & CO. LIMITED

Biddulph, Stoke-on-Trent. Telephone: Biddulph 3254. Telegrams: "Cowlishaw," Stoke-on-Trent
LONDON OFFICE: 17 Victoria Street S.W.1 Telephone: ABBey 6693

TWO SIZES FOUR SURFACES

FINISHED GROUND AT ONE PASS!



TWO SIZES . . . FOUR FACES . . . IN 30 SECONDS!

. . . that is the phenomenal production rate achieved by the **STANDARD MOTOR CO. LTD., COVENTRY,** on the grinding of the large and small ends of connecting rods, as shown. Stock removal from each face is up to 0·080 in., and uniformity of size on each pair of faces is held within 0.001 in. The infeed method of grinding used here gives considerably increased life to the grinding wheel, compared with plunge cutting between fixed wheels.

The ROWLAND DUPLEX

FOR HIGHEST PRODUCTION IN FLAT GRINDING

OUTPUT CAN BE INCREASED BY OVER 100% ON A ROWLAND DUPLEX SURFACE GRINDER.

Send us your problem.

F. E. ROWLAND & COMPANY LTD., CLIMAX WORKS, REDDISH, NR. STOCKPORT

'Phone: Heaton Moor 3021 'Grams: Heroic

SOLE EXPORT AGENTS: DRUMMOND ASQUITH (SALES) LTD. HALIFAX HOUSE, STRAND, LONDON, W.C.2. PHONE: TRAFALGAR 7224

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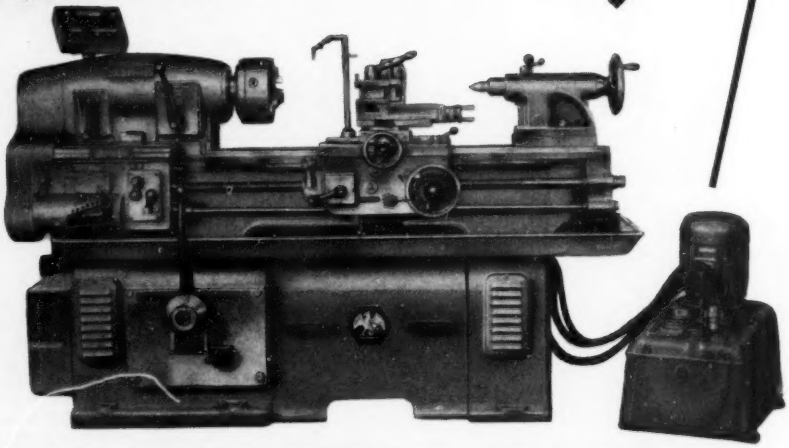
WE THINK THIS WILL SURPRISE YOU!

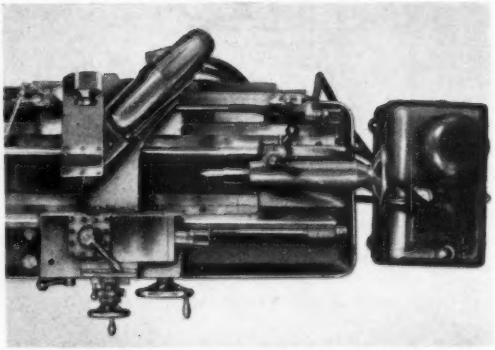


WYVERN-STILL AHEAD

with a HYDRAULIC COPYING LATHE

at NORMAL LATHE PRICE

The Wyvern Hydraulic copying lathe, fitted with the entirely reliable 'Hepworth' copying unit, can now be supplied at a price no higher than that of many normal centre lathes. This Wyvern achievement puts hydraulic copying well within the reach of even the smallest engineering shop. It can also be supplied with hardened steel bedways. Swing over bed 17in., in gap 28in. Between centres 3ft. or 5ft. Write today for a copy of our brochure, giving complete details.



WYVERN MACHINES LTD · PERCY ROAD · LEICESTER · ENGLAND · *Tel: 32080*

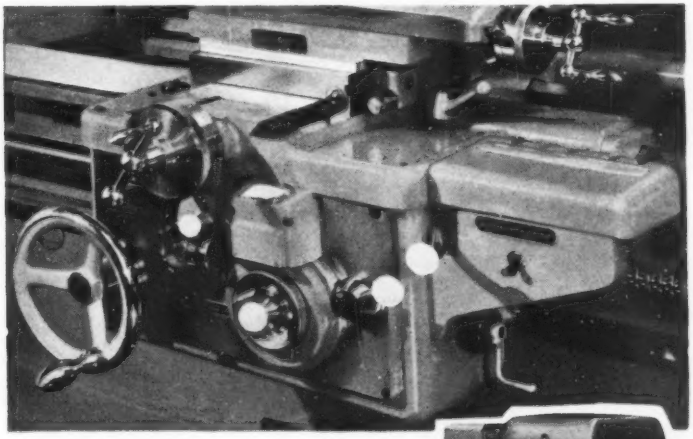
PUSH BUTTON CONTROL

The main feature is the speed control engagement, dis-engagement and reversing of the spindle. The running speed is shown on an illuminated glass panel in full view of the operator. An inching switch for setting up purposes, a signal lamp and an emergency cut out are fitted to the headstock.

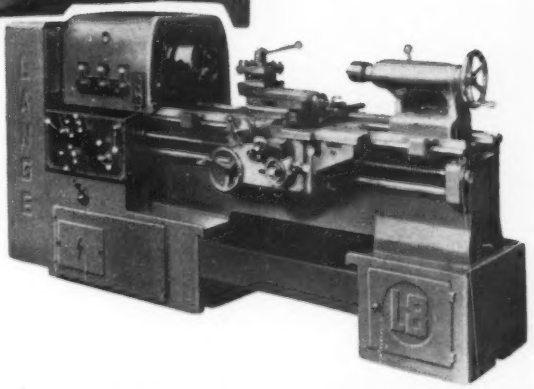
The operations necessary for going through the whole speed range are extremely simple and with a 12 h.p. capacity motor, the speed range covers 22 to 2,000 r.p.m. by P.I.V. Power controlled infinitely variable speed unit. At the minimum speed of 22 r.p.m. there is a power output of 8 h.p.

Automatic end controlling attachment

This special equipment is mounted to the apron of the lathe and saves lengthy measurements of turning lengths, formerly directly taken from the workpiece. With this attachment, the operator selects the desired turning length on the optical length dial and starts the end feed. When the required turning length is obtained, the attachment cuts out the feed by itself. When two different turning lengths are required for the same workpiece, the first length will be limited by the automatic attachment, the second one by a fixed stop. Accuracy will be the same for both.



LANGE



Specification

Height of Centres	19¼in. or 12in.
Hole through Spindle	2⅜in. dia.
Speed (infinitely variable) ..	22/2,000 r.p.m.
Longitudinal Feeds (45) ..	0·002in./0·049in.
Transverse Feeds (45)	0·0005in./0·0165in.
Distance between Centres ..	3ft. 3in., 5ft. 5in., 6ft. 6in., 8ft. 3 in. or 9ft. 6in.

BENRATH MACHINE TOOLS LTD · MANCHESTER 22 · Gatley 2227 (4 lines)

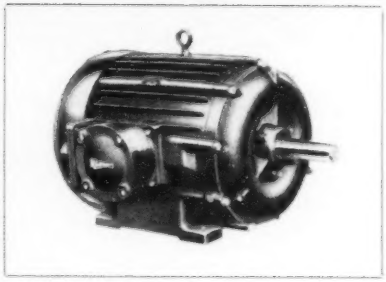
Newman

IN STEP WITH PROGRESS

INTERNATIONALLY CERTIFIED

These motors represent a triumph for Britain. It is believed that Newman is the only manufacturer outside of Canada and the U.S.A. to have Underwriters' Laboratories Inc. approval for a range of Explosion Proof motors, as well as the approval of the Canadian Standards Association and the Ministry of Power in this country.

This means that these motors can be used in hazardous locations throughout the World. They are yet another example of the NEWMAN PROGRESSIVE DESIGN POLICY.



Newman

making the pace in motor progress

NEWMAN INDUSTRIES LIMITED. YATE. BRISTOL

TAYLOR-HOBSON

PRESENT THE

NEW

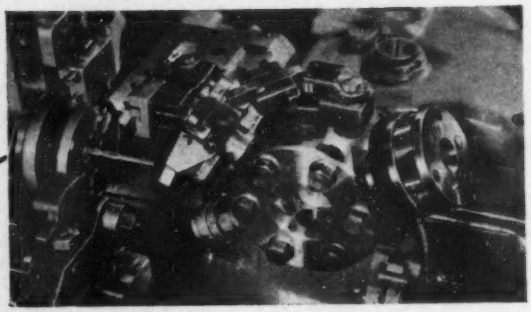
JH

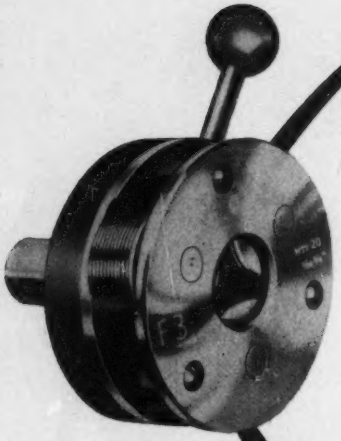
ENGRAVING MACHINES

Ask for Lists 800-16 and 2-2H

A Member of RANK PRECISION INDUSTRIES LTD

TAYLOR, TAYLOR & HOBSON LTD., LEICESTER



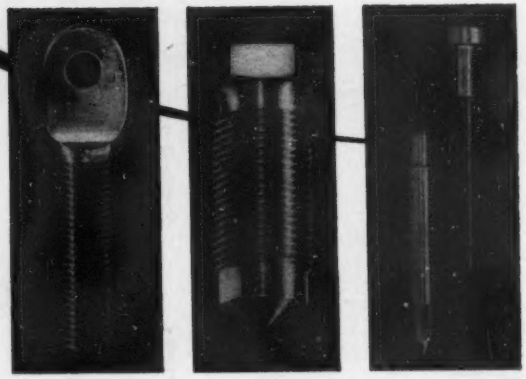


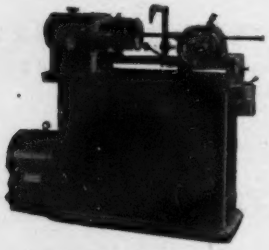
BETTER THREADS MORE QUICKLY FOR LESS COST WITH

MSE—"FETTE"
THREAD ROLLING HEADS

British Patents Nos. 705754, 744039 & 743977

Thread rolling, as opposed to cutting, has enormous advantages * — and can be carried out on your existing lathes, capstans, automatics and drilling machines, with MSE-"Fette" Self Opening Thread Rolling Heads.





MSE-"FETTE" THREAD ROLLING MACHINE

This machine has been designed for use with MSE-"Fette" Heads where volume of threads production calls for a special purpose machine. It is suitable for a range of Heads for threads up to 1¼in. diameter.

* Denser, stronger threads with a hardened surface. Faster, more economic production. Perfect threads on many "unmachinable" materials. Sustained accuracy on long runs. Saving in material costs.

MSE MACHINE SHOP EQUIPMENT LTD., Spenser St., London, S.W.1 Tel.: VICtoria 6086

MARBAIX

FOR UNUSUAL MACHINES

MINUTES SLASHED TO SECONDS . . .

on the new

MARBAIX
M58 DISINTEGRATOR

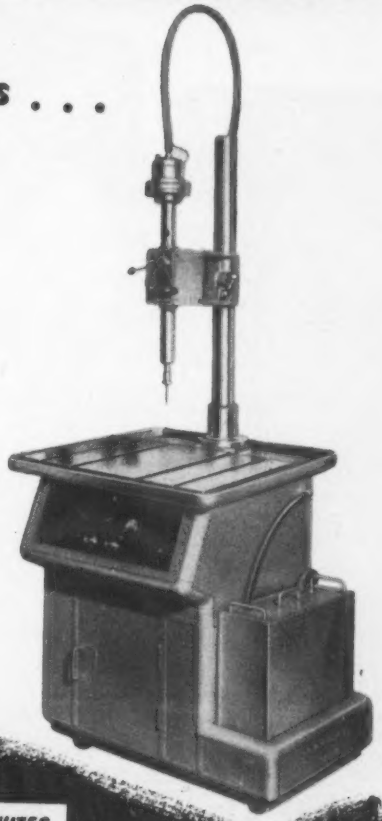
● **REMOVES BROKEN TOOLS WITHOUT DAMAGE TO THE COMPONENT**

● **CUTS HOLES OF ANY SHAPE IN HARDENED MATERIAL, CARBIDES ETC.**

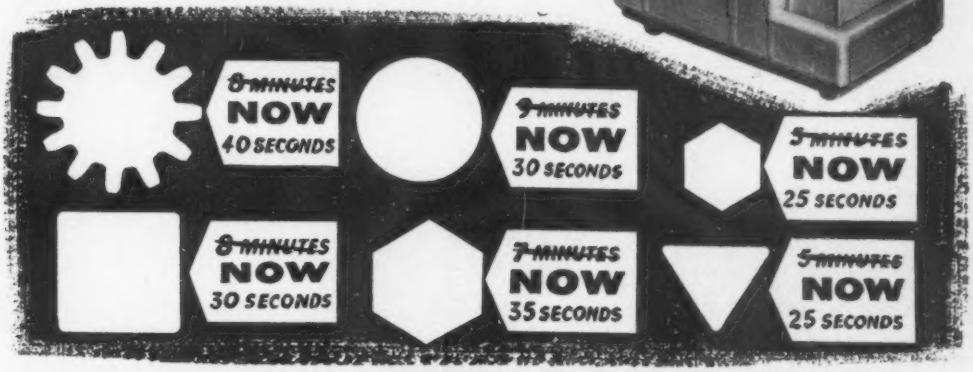
. . . in fact any material through which electric current can pass.

The new MARBAIX M.58 disintegrator removes broken taps, drills, reamers, studs, etc., in a fraction of normal time, without damage to the component.

Holes, too, of any shape can be cut in hardened material for subsequent finishing by grinding or other methods Note the times for the various examples shown, and write today for full details to Dept. M.1.



*** HERE'S HOW TO CUT COSTS**
Times obtained on Model M58-C (as illustrated)



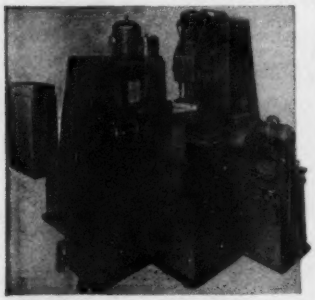
MARBAIX INDUSTRIES LTD

VALIANT HOUSE, VICARAGE CRESCENT
BATTERSEA, LONDON, S.W.11
PHONE: BATTERSEA 8888 (8 lines)

B·S·A

machines linked for automatic transfer

This is one of the possibilities of the automatic linking of B.S.A. machines. When the requirement is for medium or high-production, on standard or special purpose machines, consult B.S.A. Tools Limited



B.S.A. Hüller combined mill and drilling machine for transmission boxes.

THIS 4" dia. COMPONENT MACHINED COMPLETE on a B.S.A. 5M single-spindle automatic chucking machine (for 1st opn. work) linked with a B.S.A. ACME-GRIDLEY 6" six-spindle chucking machine. After 1st opn. machining the component is conveyed via the overhead chute to the multi-spindle machine. The component is transferred to the chuck electro-pneumatically within the automatic cycle of the machines.

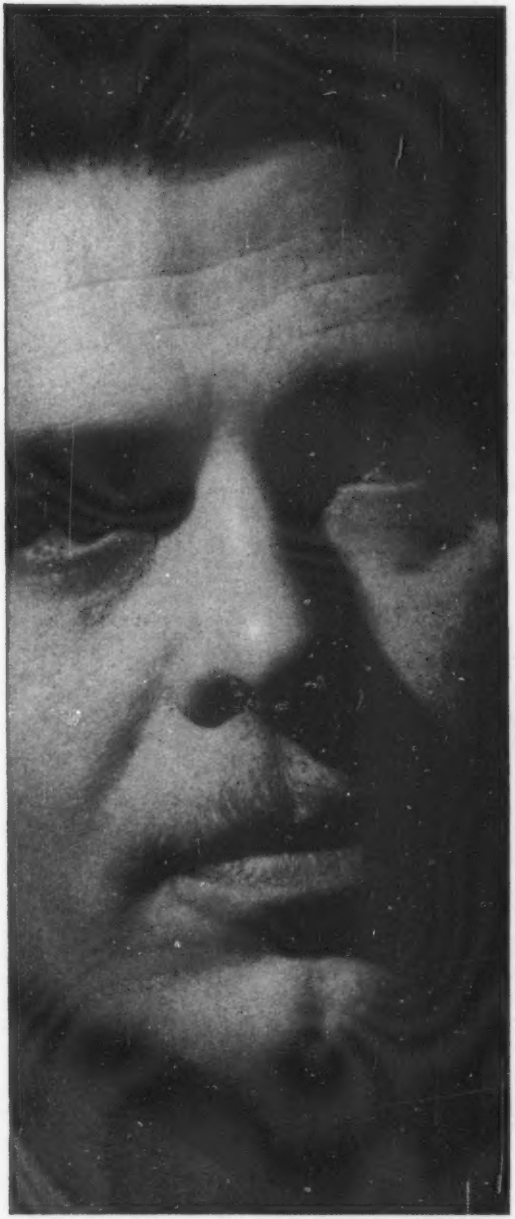
B.S.A. TOOLS LIMITED · BIRMINGHAM 33 · ENGLAND

SOLE AGENTS GT. BRITAIN BURTON GRIFFITHS & CO. LTD. · KITTS GREEN · BIRMINGHAM Telephone: STECHFORD 3071

From the B.S.A. range of single- and multi-spindle automatic bar and chucking machines, thread and form generators, multi-tool and copy turning lathes, centreless grinders, broaching machines, special purpose machines and small tools.

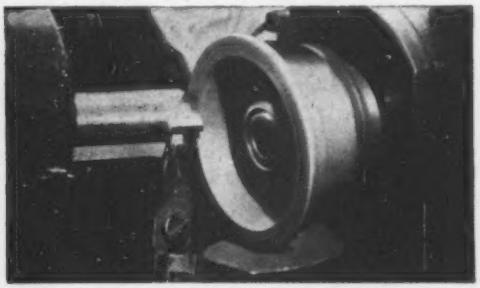
406

CUSTOMERS OF CARBORUNDUM



"We get more jobs out of each wheel with these" says **Tom Swain**

Tom Swain is the charge-hand of the cutter-grinding shop of Jonas & Colver (Tools) Limited. Most of the tools they grind there go to the motor industry or the aircraft industry. Among the most successful production tools that Tom's men use are the resin-bonded diamond wheels made by CARBORUNDUM shown in our smaller illustration. 'We find we get more jobs out of each wheel with these.' Tom says, 'And that's important with diamond wheels. Diamonds cost money!' He might have added that long wheel-life saves time spent in wheel changing, and so increases the production rate — not a big increase, but worth something in the course of a year.



CARBORUNDUM can help YOU

Tom Swain knows what he's talking about — and in almost all the major industries of the world there are men who talk about us in the same way that Tom does: men who know that products by CARBORUNDUM are helping them to make better products, to cut costs, and to speed production. Trade barriers in Europe are falling, and competition will sharpen as they fall. High quality, low price, and early delivery dates will be the keys to the expanding European market. There will be rich prizes for those who can meet the challenge of the new Europe. Abrasive and refractory products by CARBORUNDUM can help *you* to win them.

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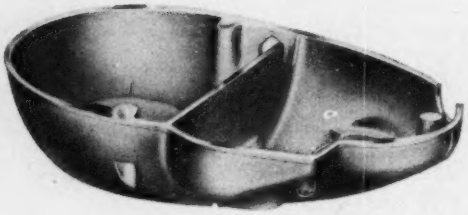


MACHINING TIME CUT BY NEARLY 2/3 on Villiers magneto covers

PREVIOUS METHOD *Face milling on vertical miller*	**13** pieces per hour
PRESENT METHOD *Face milling on Wadkin Router*	**32·4*** pieces per hour

* *When the operator becomes fully proficient in the operation of the Wadkin Router, the rate of production is expected to reach 37 pieces per hour.*

The Wadkin High Speed Router does the face-milling operation on this light alloy magneto cover with a saving of more than 60 per cent. of former machining time. This is not an unusual result—it's typical of the Wadkin Router's performance on Non-ferrous Metals. Unlike conventional machines, the Wadkin L.S.M. shown on right, has cutting speeds up to 24,000 r.p.m. This guarantees a perfectly machined face requiring no further finishing operation, and only light clamping of the component is necessary. May we tell you more about the amazing time-saving possibilities of these Wadkin high speed milling machines?

Wadkin

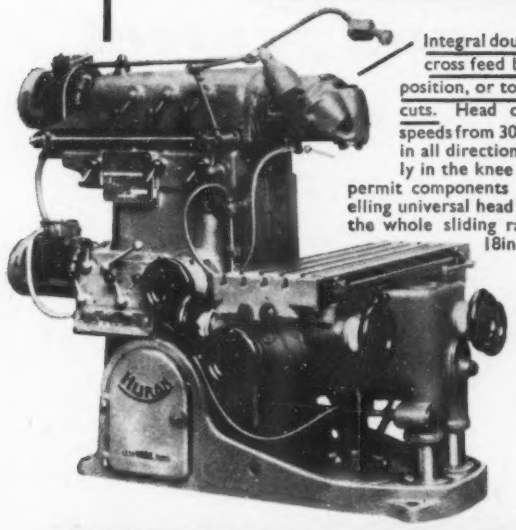
Wadkin Ltd., Green Lane Works, Leicester
Telephones: Leicester 67114 & 66021
London Office: 62 Brook St. W.1. *Tel: MAYfair 7048*

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS

SLIDING RAM GIVES 27½in. AUTO CROSS FEED



Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m. 27 feeds from $\frac{1}{15}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in automatic cross movement needs only 18in. clearance.

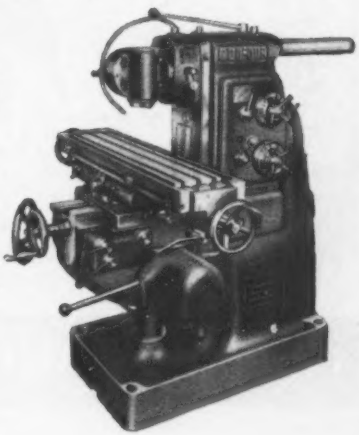
Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56$\frac{7}{16}$in. × 15½in.	43½in.	27½in.	19½in.
KU5	64$\frac{7}{16}$in. × 15½in.	51½in.	27½in.	19½in.
KU6	78½in. × 16½in.	59in.	27½in.	19½in.
L7	157in. × 39in.	118in.	27½in.	39½in.

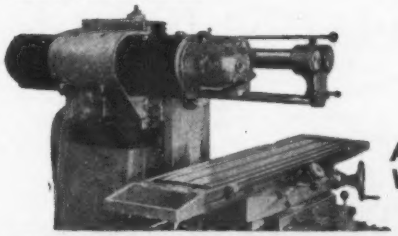
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting.
The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table Upright slides full length of base table, and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

Table surface 43$\frac{5}{16}$in. by 9$\frac{7}{8}$in. or 47½in. by 10$\frac{7}{8}$in. Auto long. feed, 26½in. or 30½in. Auto vert. feed, 15½in. or 18$\frac{7}{8}$in. Auto cross feed 9½. Rapid traverse in all directions. No. 40 International taper for main spindle, universal head, and rotary table. Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Spindle speeds 21 to 1,600 r.p.m. Twin overarms. Separate motor for rapid traverses.

Dufour No. 54 Universal Miller. Table surface 62.99in. by 14.763in. Automatic long. feed: 39.37in.; vert. 20.275in.; cross: 14.173in. and automatic cross feed of universal head 25½in. Manual vert. feed: 4½in. 18 spindle speeds for universal head: 12 to 1,500 r.p.m. 36 spindle speeds for horizontal spindle 6 to 1,500 r.p.m. Can also be supplied as plain miller, with central detachable universal head, or with side universal head, without automatic feed.





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We supply* EX-STOCK *and demonstrate* CLARE *Chucks and Collets

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.
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FLETCHER MILLER *Machine Tool Lubricants*

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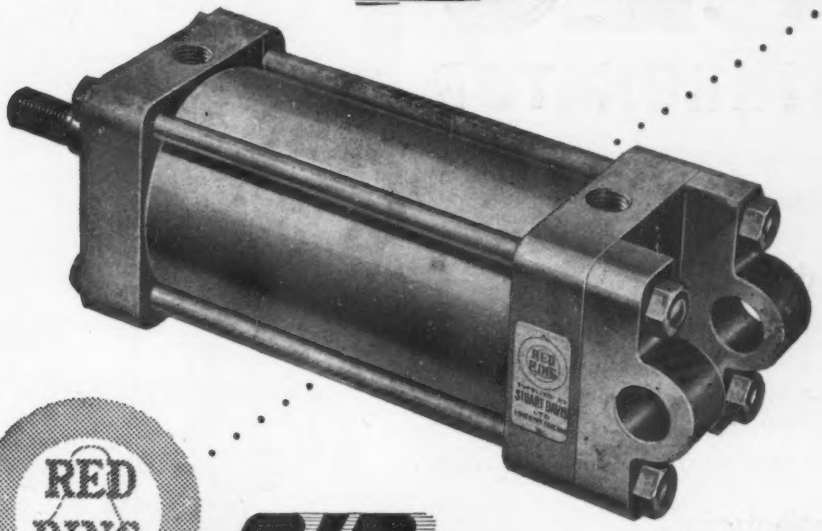
MTL 34

basic elements of AUTOMATION



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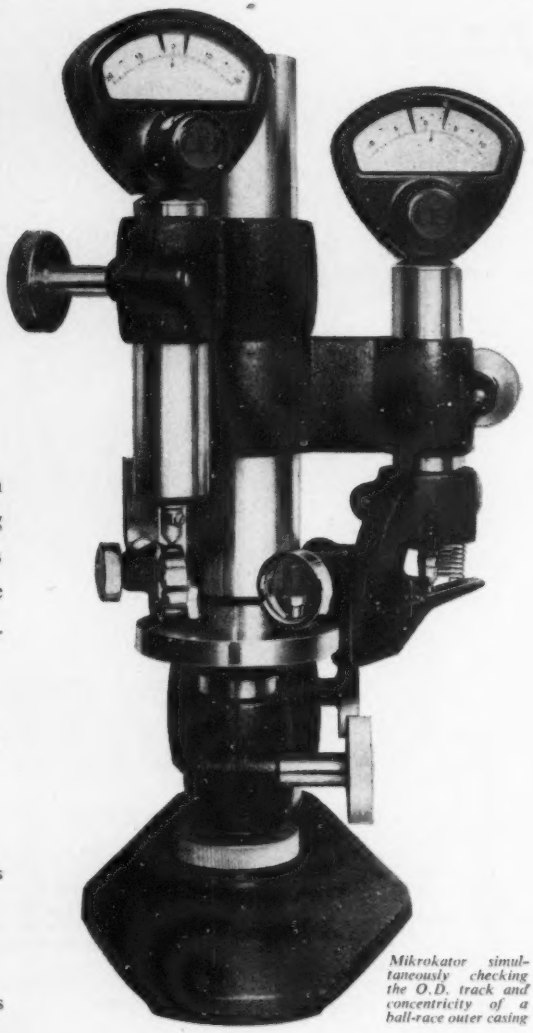

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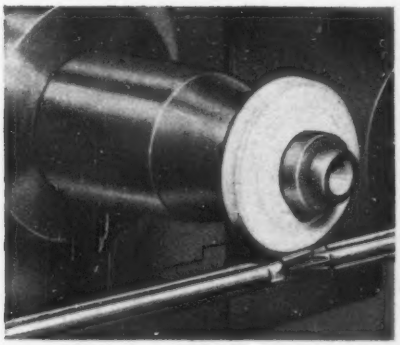


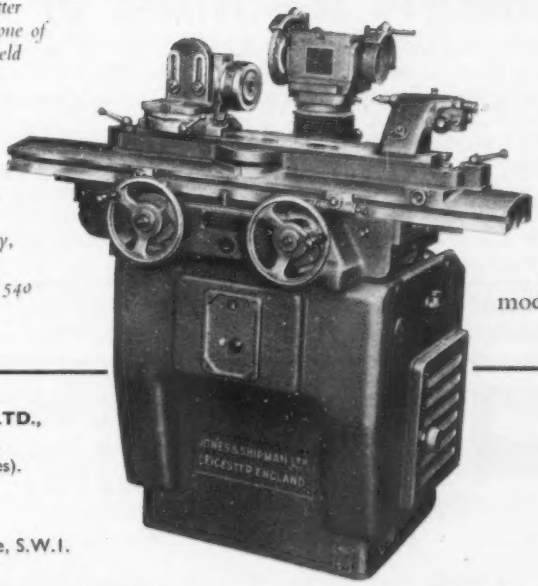
Grinding flutes from solid in four-fluted Tungsten Carbide tipped reamer on a Model 310 Cutter and Tool Grinder.

grinding carbide tipped cutting tools

Flute grinding Reamer with Tungsten Carbide inserts on a Model 310 Cutter and Tool Grinder.

JONES & SHIPMAN

The grinding of this type of cutter requires a specialised knowledge and one of the foremost companies in this field are Messrs. Goodyer-Blackburn Ltd., Handsworth Road, Sheffield, who supply many of the automobile and aircraft firms with tungsten carbide cutting tools. In their well-equipped factory, Jones-Shipman Precision Grinding Machines are used exclusively, particularly the Model 310 Cutter and Tool grinder and Model 540 Surface Grinder.



model **310**

A. A. JONES & SHIPMAN LTD.,
Narborough Road South, Leicester.
Telephone: Leicester 823222 (8 lines).
Grams: " Chuck " Leicester.

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5, Vandon Street, Buckingham Gate, S.W.1.
Telephone: ABBey 5908/9.

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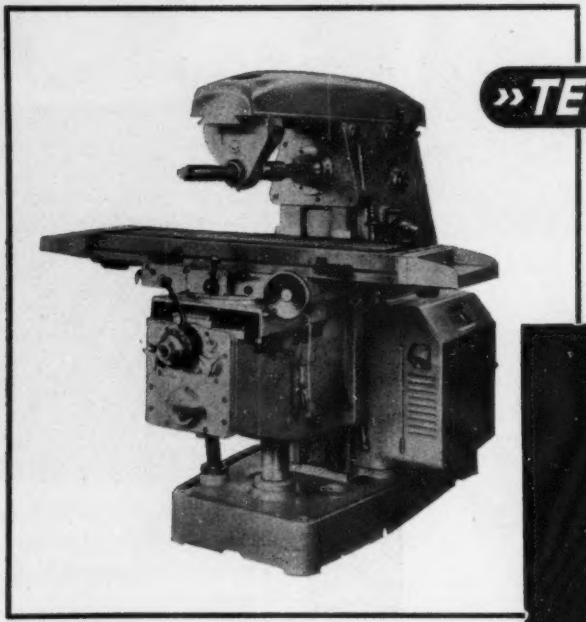
One lever does everything!



»TECHNOIMPEX«

Illustrated left
Universal Model Type UF 22

VERTICAL & UNIVERSAL MILLING MACHINES UF & VF 22

A high production machine with the combined electrical, hydraulic and mechanical drives controlled by a single lever. Sturdily built and weighing 4 tons, the design ensures easy operation. The spindle is driven off the main motor through Vee-belts and a 20-speed gearbox. All gears are precision ground. Table, saddle and knee feeds and rapid traverses are driven from a separate traverse motor which forms an integral unit with the feed gearbox arranged inside the knee. A single lever controls spindle rotation, engages the selected spindle speed, and all feeds and rapid traverses. Standard equipment includes 12 h.p., 2½ h.p. and 0.14 h.p. motors; coolant pump and piping built integrally with motor; work light.
Both horizontal and vertical type Milling Machines are in stock and may be inspected in our Bristol showrooms.

20 SPINDLE SPEEDS	**19 – 1500 R.P.M.**	**Table overall size 60in. by 15in.**
18 FEEDS	**9.8 – 500 m.m/min.**	**Table traverse 36in.**

Sole Selling Agents UK for Hungarian Heavy Machine Tools (TECHNOIMPEX)

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Machine Tool Division
YATE, BRISTOL, ENGLAND
Telephone: Chipping Sodbury 3311 *Telegrams: "DYNAMO YATE"*

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Then we process it on equipment made by names such as Bridge, Iddon, and Shaw, and on many ingenious machines made by our own engineers.

We know those with sufficient money can also buy these quality materials and machines, but to make the BEST V-Belts it takes 'know-how'. We have a team led by Tom Hall (A.I.R.I. since 1932) who have been improving V-Belts continuously for 21 years. If only the best at a competitive price is good enough for YOU, then Fenner V-Belts are the ones to buy.

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FOR HIGH STRESSES —MINIMUM DEFLECTION UNDER LOAD

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DIVISION OF BLACK-CLAWSON INTERNATIONAL LTD. MAKERS OF PAPER MILL PLANT

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Plano Miller FP16

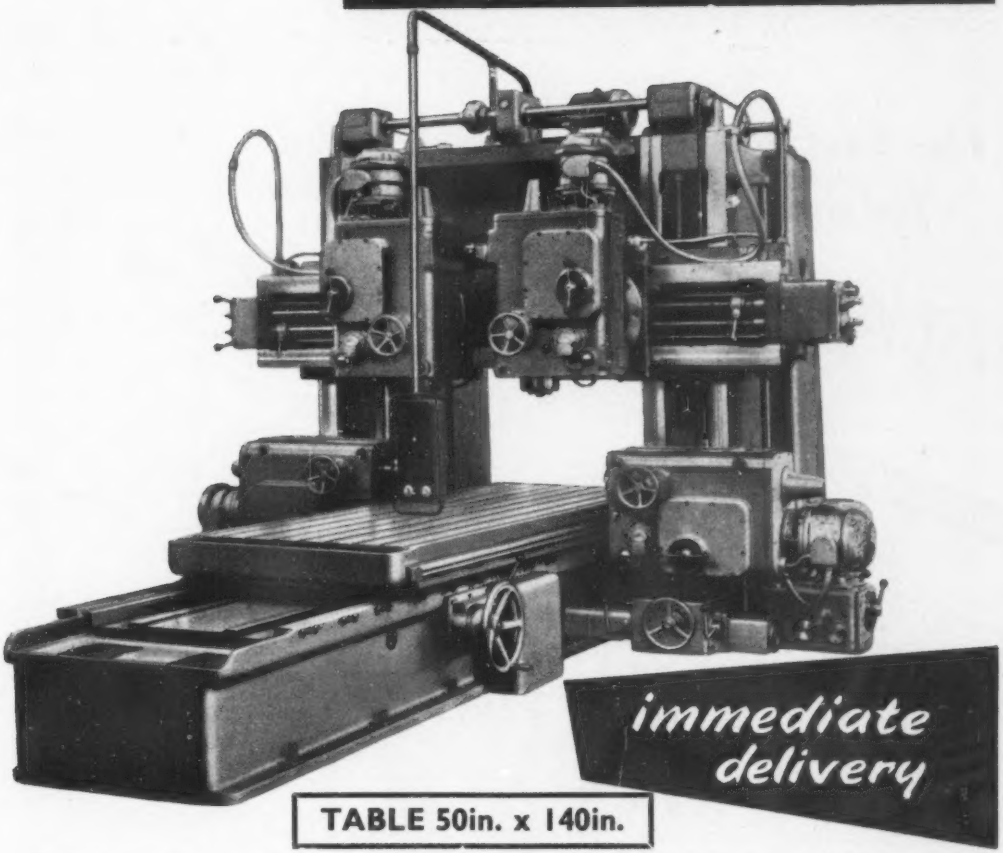

TABLE 50in. x 140in.

- Wide range of Spindle Speeds enabling use of high-speed steel and cemented carbide tipped cutters.
- Table speeds infinitely variable.
- Independent drive to individual headstocks, individual drive to table and headstock feeds.
- Automatic clamping of cross rail to guideways.

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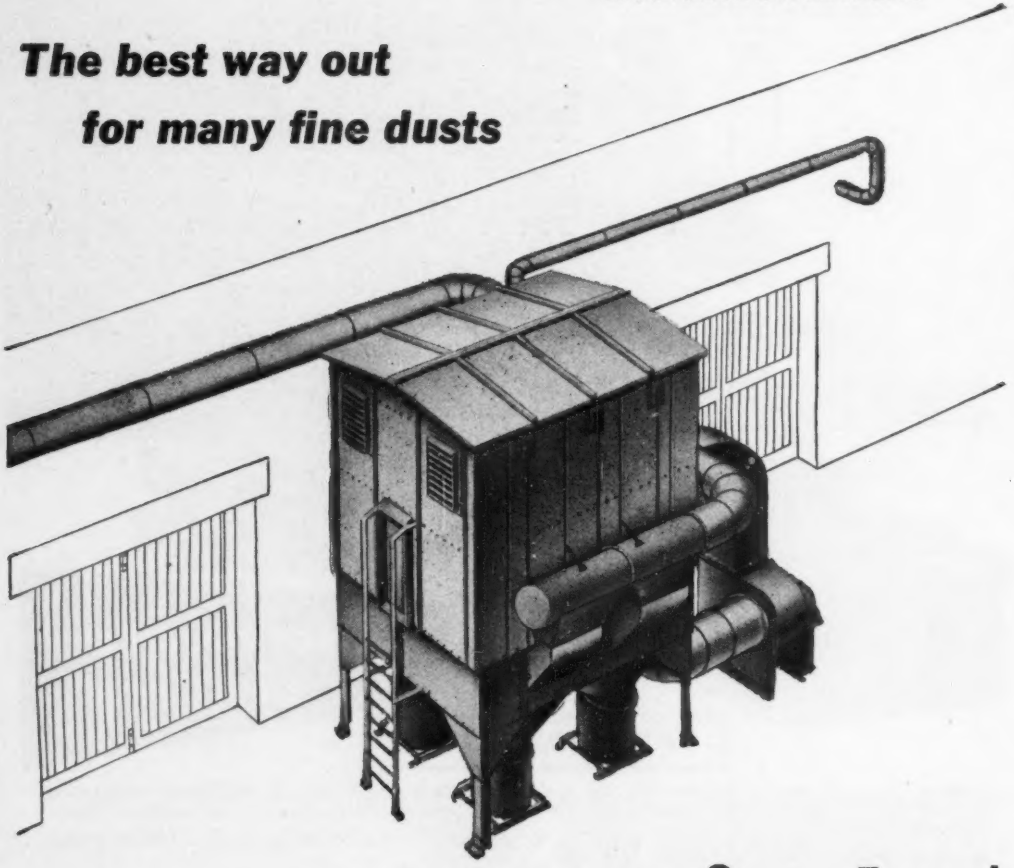
The best way out for many fine dusts



see us for dust

DALLOW LAMBERT

DUST CONTROL EQUIPMENT FOR INDUSTRY

There's a resident Dallow Lambert man in your area.

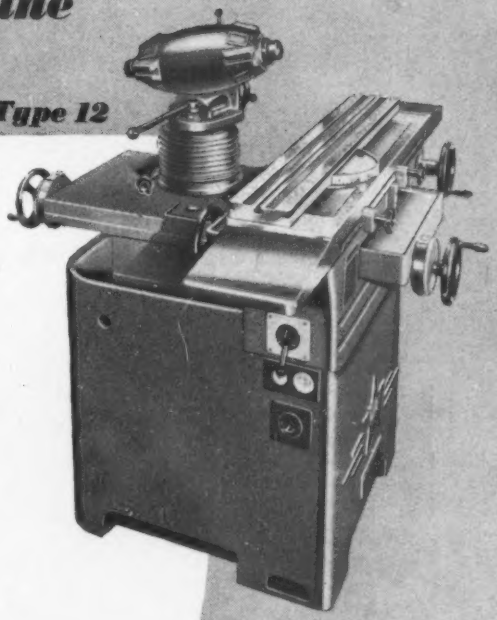
DALLOW LAMBERT & COMPANY LIMITED, THURMASTON, LEICESTER

CEC71

HABIB

Universal Tool and Cutter Grinding Machine

Type 12



Fitted with a swivelling table and universal movement to the wheelhead, this precision built, medium size machine is designed to meet many tool reservicing requirements, and enables a wide range of tool and cutter forms in H.S.S. or Carbide to be ground with speed and accuracy at low cost.

A sturdy machine bed provides full support to the transversal slides during maximum feed strokes and smooth positive table movements are ensured by dust proof prismatic slides with ball bearing motion. Controls are accessibly positioned to promote maximum operator convenience and high productivity.

Easily mounted fixtures facilitate rapid set-up and a full range of accessories are available for plain or universal grinding.

Sturdy bridge type construction.

Channelled castings facilitate coolant return.

All angles obtained direct from the wheelhead.

Independent type wheel arbor with collet type wheelhead spindle.

Unimpeded all round operation.

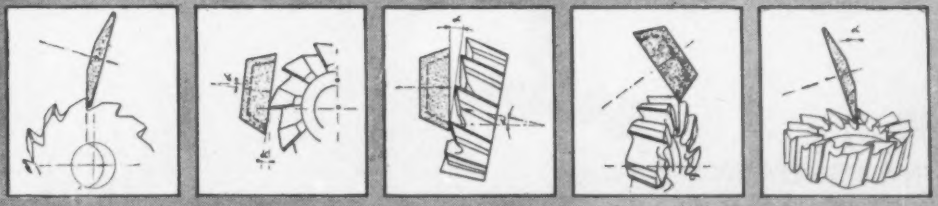
Duplication of controls at front and rear of machine.

All attachments and adjustments readily clamped by hand.

BRIEF SPECIFICATION

Distance between centres	25 ⅛ inch
Vertical run of wheelhead	10 ½ inch
Maximum diameter between centres	11 ⅛ inch
Maximum Face Mill diameter	16 inch

The tilting wheelhead



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can increase production from 30% to 100%

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Patents Nos. 728898, 743461 and 23176/57

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LIPE ROLLWAY

Automation Ltd.

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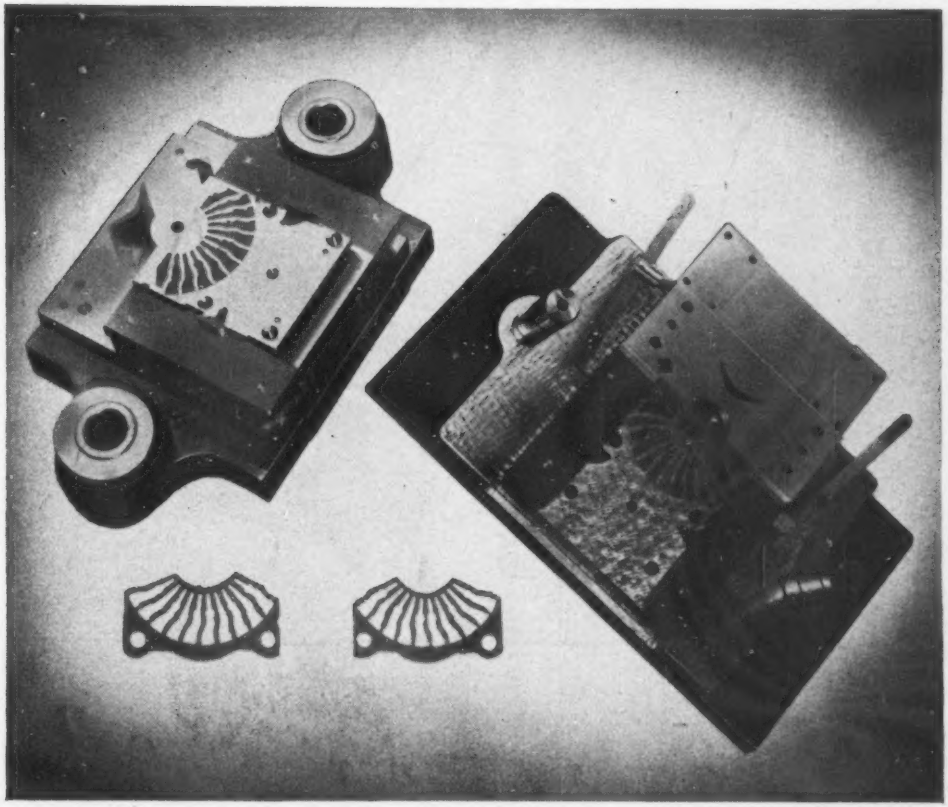

Compound Tool for Terminal Plate Bank Assembly. Illustrated by courtesy of The Automatic Telephone & Electric Co. Ltd.

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Makers of Press Tools, Gauges, Jigs, Fixtures, etc.

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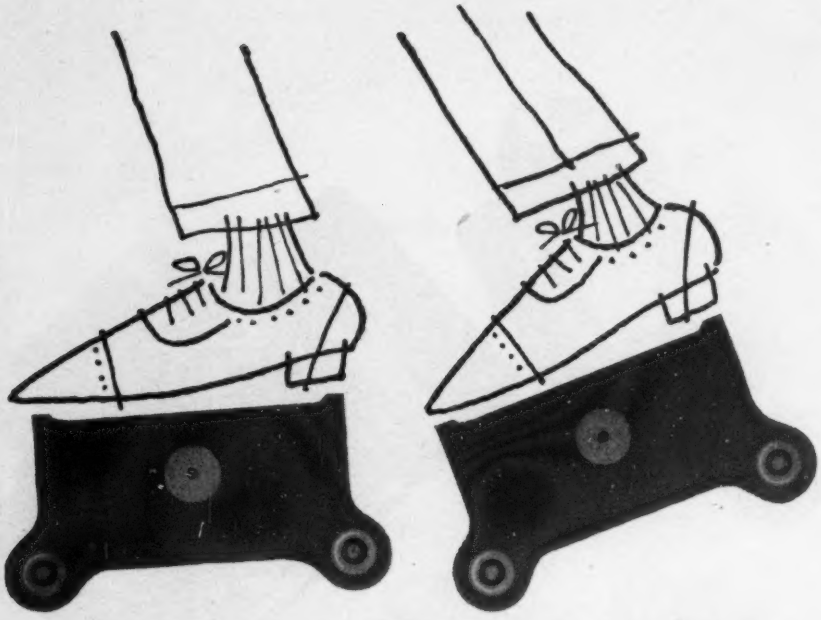

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for internal and external superfinishing
This illustration shows external superfinishing on Gudgeon Pins in the Patricroft Works of L. Gardner & Sons Limited, the well-known oil engine builders. Gehring machines are also employed in the same factory for high precision bore finishing on cylinder blocks.
A wide range of Gehring Honing Machines is available for single- and multi-spindle operations. Write today for details, mentioning the type of application you have in mind.
GEHRING

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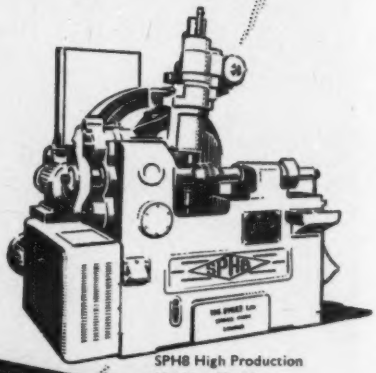
'Phone: Midland 2431 (7 lines) 'Grams: Maxichape, B'ham. Also at LONDON: 'Phone: Trafalgar 7224 (5 lines) and GLASGOW: 'Phone: Central 0922

in 60 seconds

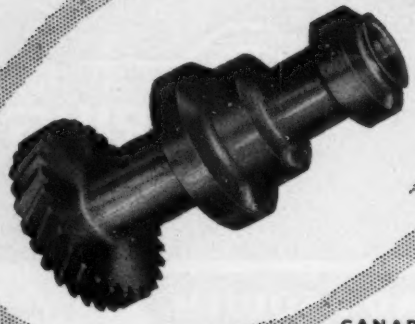
the time it takes to read this advertisement . . . .

In many instances a gear may be hobbed in precisely the time necessary for subsequent finishing by the shaving method. Thus, the SPH8 can work in unison with a Shaving Machine to provide high rates of production. The gear illustrated is 3·188in. p.c.d. and ⅝in. face width, having 29 teeth of 11 N.D.P., 30·42 degree helix angle, and 20 degree pressure angle. The material is Manganese-Chrome oil hardening steel, EN 18C. This component is regularly cut in a floor-to-floor time of only 60 seconds; the degree of accuracy obtained being adequate for subsequent finishing by the shaving process.



SPH8 High Production Hobbing Machine

the SPH8 will cut this gear



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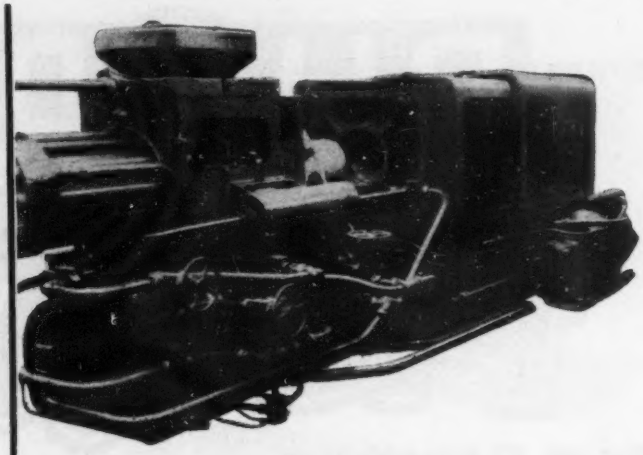
THE FINEST IN THE WORLD

17 PRESSES SUPPLIED to the SOVIET GOVT.



The Herbert/Reed-Prentice Fully Automatic Injection Moulding Machine is worthy of the famous name of Alfred Herbert Ltd. whose exacting standards are met by VICKERS-DETROIT *hydraulics. The foot mounted double pump illustrated below is one of a pair incorporated into the hydraulic system.*

things that matter

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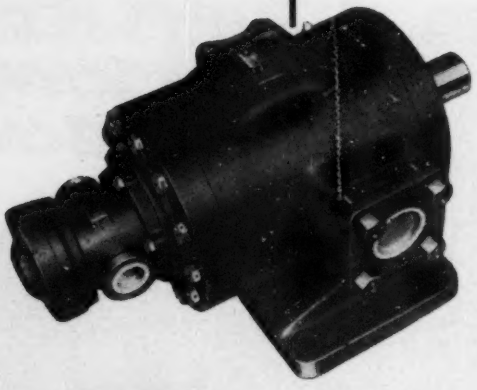

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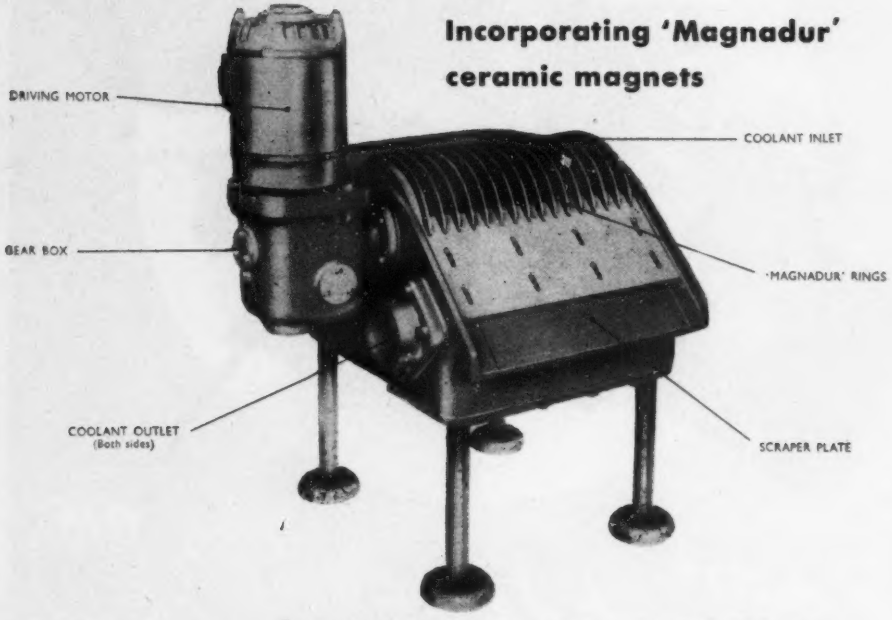

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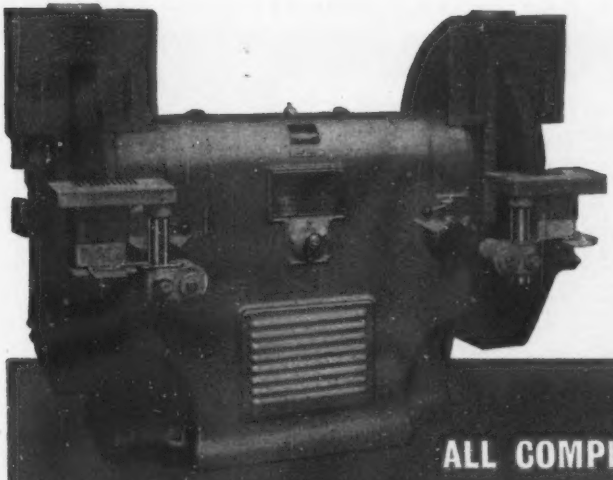

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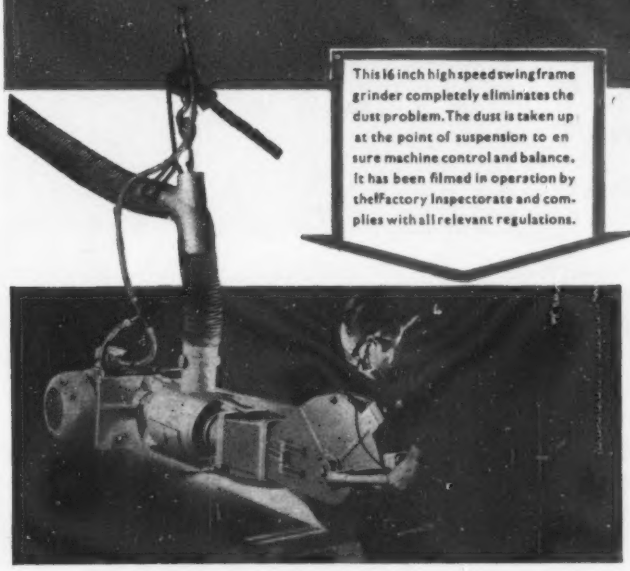

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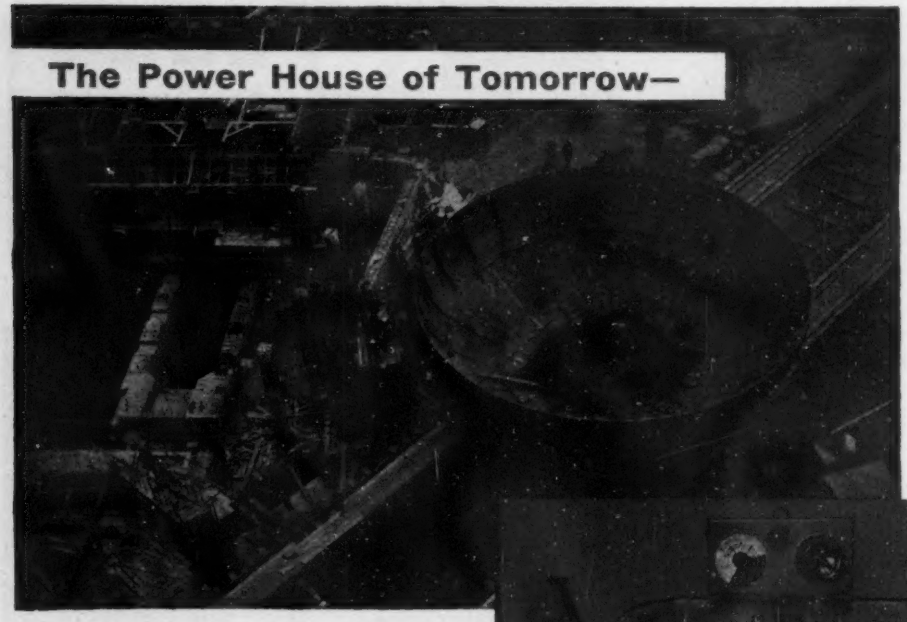

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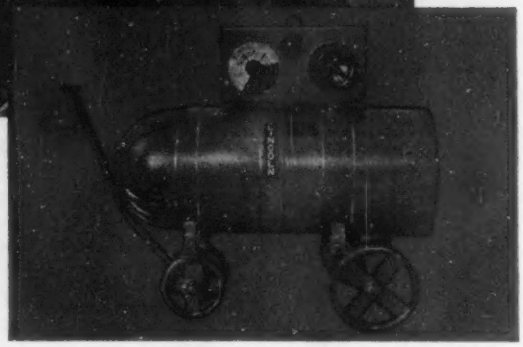

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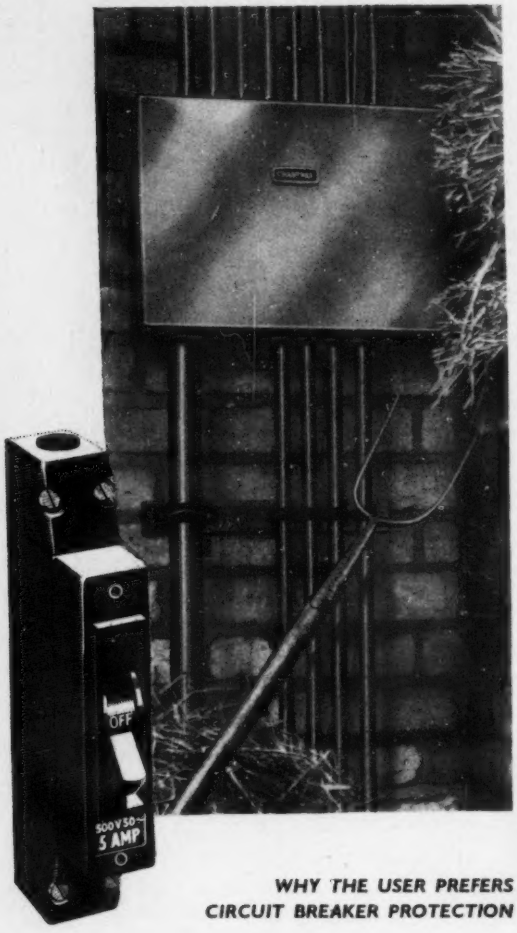

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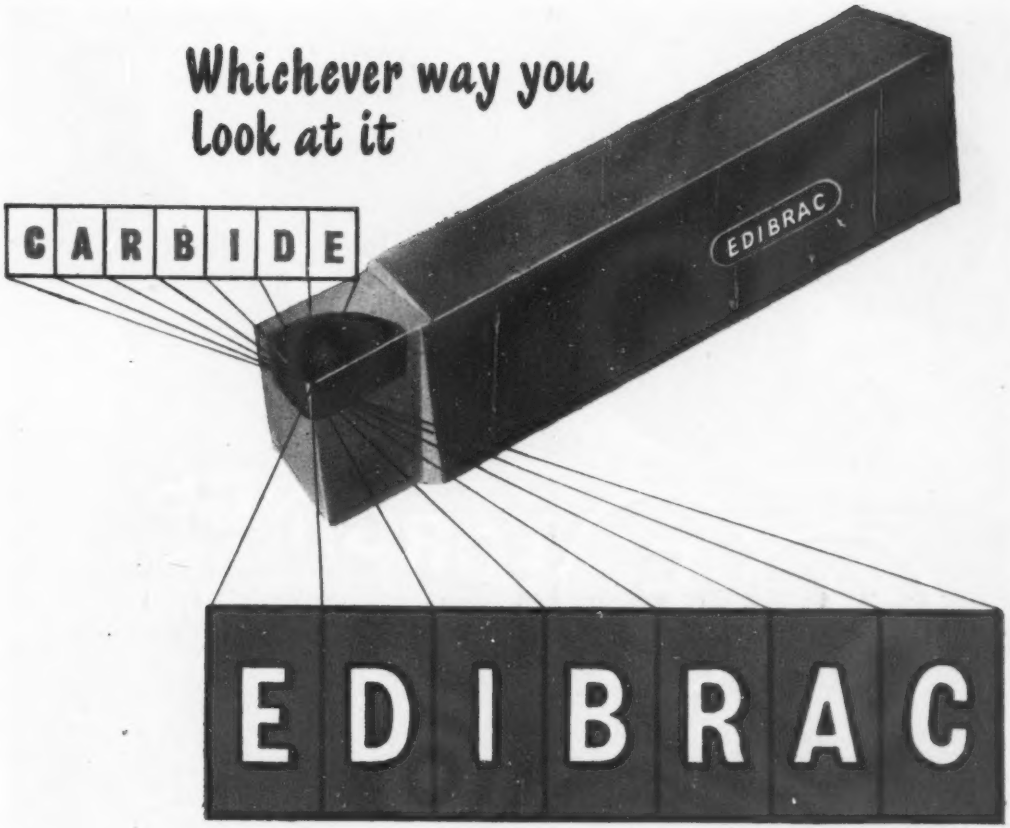

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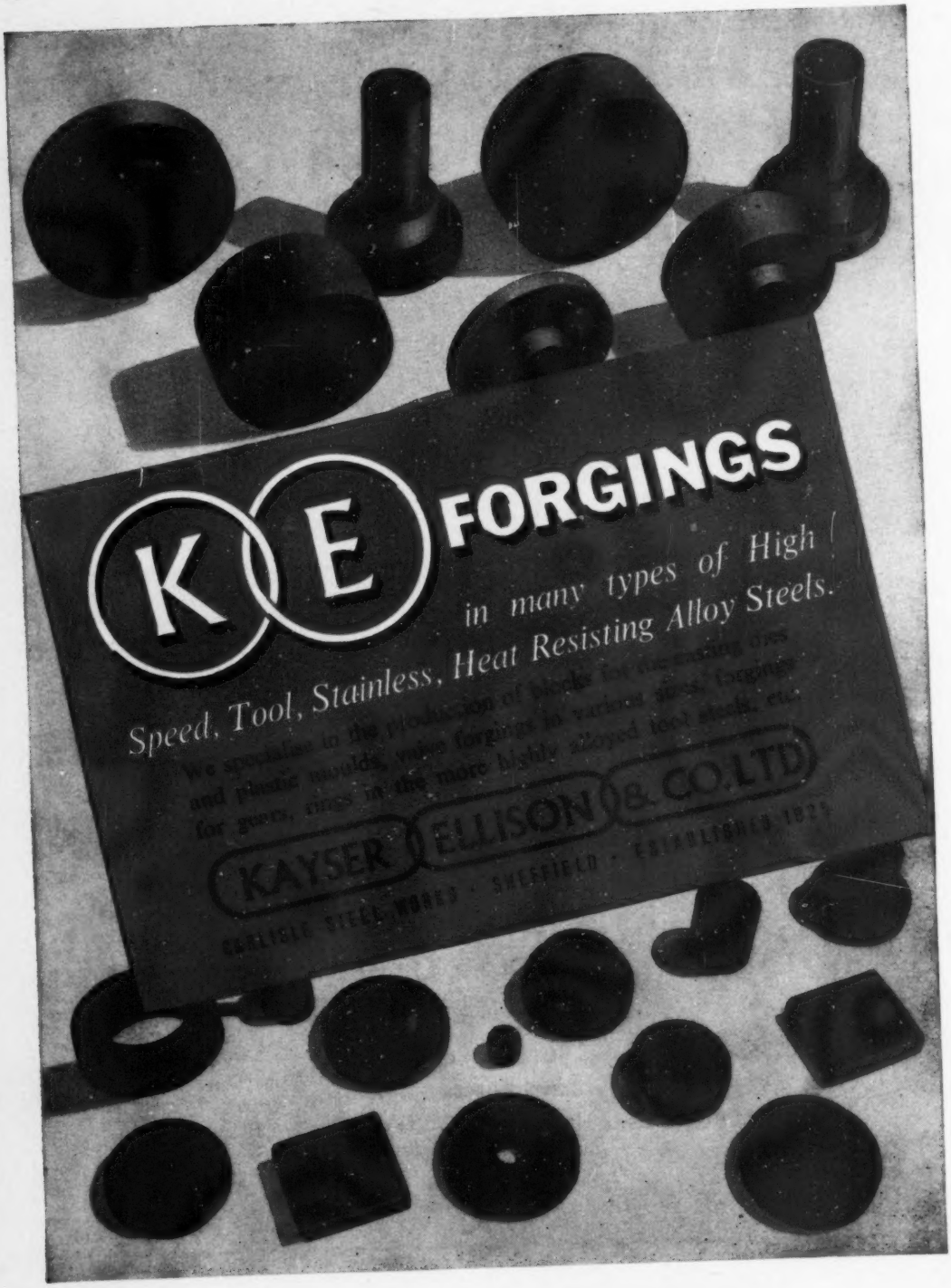
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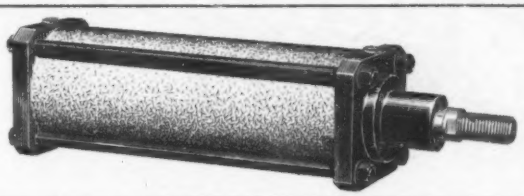

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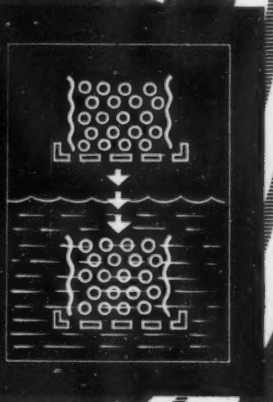

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Abstracts of Principal Articles

The Production of Calculating and Ticket-issuing Machines ..... P. 1192

The wide range of products of the Bell Punch Co., Ltd., Uxbridge, includes calculating machines, totalisator equipment, ticket-issuing machines and aircraft instruments. Components for aircraft instruments are made in small batches, and a universal fixture has been developed for machining 41 different aluminium-alloy forgings and castings. The fixture incorporates hydraulically-operated clamping units, and work-support and location units, which are mounted on magnetic chucks with the aid of templates. Main frames for the instruments are machined by fly-cutting, with the castings held in a fixture which incorporates fixed and sliding knife-edge clamping members. Step-cams for totalisator ticket-issuing mechanisms are produced to close limits by a simple milling set-up, in which a special dividing head is employed to position the workpieces longitudinally and angularly. An indexing fixture is provided for checking. Many of the smaller components for the company's products are finished by profile engraving on pantograph machines, and to facilitate milling flats and engraving identification symbols on printing wheels, the company has developed an automatic indexing arrangement for the master templates, which is controlled from the work-fixture. Small holes are finished by fine-boring, and a Pultra lathe for this work has been equipped with cam feed for the tool slide. Holes in small pressings are reamed on a Hüller tapping machine fitted with an indexing fixture. (MACHINERY, 92—23/5/58.)

Further Developments in Tools with "Throw-away" Tips ..... P. 1204

As a result of the increasing adoption of "throw-away" tip tooling there have been considerable developments in the methods employed for holding the inserts. Mention has been made already in MACHINERY (87/1199—18/11/55) of a number of commercially-available lathe tool-holders for throw-away tips, and this article gives further examples. Throw-away tips are now being used for milling cutters and boring and trepanning tools, and details of the tip-clamping methods used by a number of manufacturers are here discussed. The points which must be borne in mind when a change-over to throw-away tooling is contemplated are considered, as are the standard sizes and grades of tips obtainable. Attention is drawn to the need for regular and predetermined indexing of the tips, if this method of tooling is to be exploited to the full. (MACHINERY, 92—23/5/58.)

Ferodo Sintered Metal and Cerametallic Friction Materials ..... P. 1213

Ferodo, Ltd., are now producing sintered metal facings for new designs of clutches and brakes, also replacement facings. It is pointed out that these sintered metals will not replace asbestos-based products, but will enable clutches to be designed for duties beyond the scope of conventional facings. The production and properties of the sintered facings are briefly described, and attention is drawn to their particular advantages for electro-magnetic clutches. Cerametallic materials have also been introduced for applications demanding high heat and wear resistance, combined with good abrasive properties. (MACHINERY, 92—23/5/58.)

Mechanical Handling Aids in a Modern Swedish Factory ..... P. 1215

At the works of E. A. Bergs Fabriks A.-B, Sweden, the problems of material and work handling have been carefully studied, and a considerable amount of equipment for this purpose has been designed and made by the company. Some representative examples are here illustrated and briefly described. (MACHINERY, 92—23/5/58.)

Special-purpose Measuring Equipment P. 1218

Two items of special-purpose measuring equipment devised by D. Napier & Son, Ltd., Acton, London, W.3, in connection with their programme of gas-turbine development and production, comprises an arrangement for checking turbine and compressor discs, and an air-flotation fixture for large, heavy components. Incorporating two dial-gauges, the disc-checking fixture simultaneously checks thickness and relationship to a datum plane, at predetermined radial distances. The air-flotation fixture facilitates both the internal and external checking of items such as engine casings, by means of dial-gauges, and provided that loading is not excessively eccentric, accurate gauging can be performed rotationally, with the work "floating." If eccentric loading is heavy, pressure is released, and static readings are taken. (MACHINERY, 92—23/5/58.)

Hitch-feed for High-speed Lamination Presses ..... P. 1237

A hitch-feed mechanism which has been designed for application to a Flexopress provides 15-in. feed increments at the rate of 150 per min. when laminations are being blanked from coil stock. It is stated, however, that the press has been operated, with the same feed increment, at 225 strokes per min. corresponding to a stock feed rate of 3,375 in. per min. With this mechanism, stock up to 30 in. wide can be handled, and the feed can be varied from 0 to 18 in. A feature of the Flexopress is that the ram is guided in four pre-loaded ball ways. (MACHINERY, 92—23/5/58.)

IN FORTHCOMING ISSUES

The production of components for portable electric tools—East German machine tools at the Leipzig Fair.

Machine Tool Slide Problems

In view of current and probable future demands on machine tool performance, in order that increasingly high standards of work accuracy can be achieved with systems of fully automatic electronic control, it will be necessary, in many instances, to re-examine the problems associated with sliding movements. The term slide is here used in its widest sense to embrace all parts which have straight-line travel, and may include quite light members at one end of the scale, and, at the other, massive columns or tables with individual weights of many tons. A slide must follow a straight path in a given direction within certain limits of accuracy, and it may be necessary to control its position on the line of movement, either for a series of settings or continuously while machining is in progress. In this connection it may be difficult to achieve the desired combination of sensitivity and stability.

Some of the problems associated with slide movement were discussed by Dr. F. Koenigsberger, D.Sc., M.I.Mech.E., M.I.Prod.E., during the course of a paper presented at the Third Production Conference which was held recently at Olympia, London. The paper was concerned with "the design of automatic machine tools for electronic control," and the author expressed the opinion that certain of the problems were "in matter as well as in degree, so different from those hitherto encountered and solved, often purely empirically, by machine tool designers, that a more fundamental approach is essential, which tackles the job almost from first principles." Dr. Koenigsberger went on to suggest that a combined operation between scientist and designer was necessary, and that methods must be employed which "would have appeared out of place in an industrial workshop not many years ago." Co-operation must involve something more than mere applied research, it must provide for research into design problems, the results of which are immediately tried out on design development, "thus closing, as it were, the loop of the exercise."

Attention was drawn, in the paper, to work on the fundamental design elements for electronically controlled machine tools which is being carried out at The Manchester College of Science and Technology under the sponsorship of the National Research Development Corporation, and in this connection accuracy of alignment was discussed. On many modern machine tools, initial alignment of a high order of accuracy is obtained, but where further improvement is sought, it is suggested that, in order to avoid excessive first and maintenance costs, alignments might be related to datum lines or faces on components which are not subjected to any load. For example, a table and spindle head may be required to move in directions at right angles. If, as a result of wear or slight initial errors, some lateral movement or yaw of the table occurs, this movement might be measured in relation to a fixed straight-edge of high precision. Correction could then be applied automatically by imparting suitable movements to the spindle head and table, with the result that accurate compensation would be made and the error in table direction would not be reflected in the work. Similar corrections could be made where 3-dimensional movements are required, also for possible displacements of a spindle in its bearings, but the complications involved will require to be studied after the basic 2-dimensional problem has been solved.

With sufficiently accurate movements in directions at right angles, or the means of automatically correcting errors in those movements, it remains to control the position of the slide at any time or at all times in relation to a datum in the form of a scale. Control systems are available for this purpose, but the final work accuracy is likely to depend on the force required to move the slide, and more particularly on variations in that force under different conditions. Much work has already been done in connection with methods of reducing resistance to slide movement, or irregularities in resistance, for example by the use of balls or rollers, plastics guiding surfaces, and improved lubricants and means of application. "Viscous friction," which, according to Dr. Koenigsberger, is often desirable because of its damping effect, may thus be incidentally reduced, but the principal consideration must be the avoidance of a high coefficient of static friction and associated "stick-slip."

Recently, increasing attention has been directed to the use of oil under pressure for supporting slide weights, and such an arrangement has been adopted to facilitate accurate setting of a large hobbing machine. It is understood, moreover,

(*Continued on page* 1249)

The Production of Calculating and Ticket-issuing Machines

Methods and Equipment Developed for the Batch Manufacture of a Wide Variety of Precision Components by the Bell Punch Co., Ltd., Uxbridge

The Bell Punch Co., Ltd., was established in 1878 to acquire the patent rights of an American hand-registering ticket punch, which had been adopted by a few tramway companies in this country, and the original factory was in Tabernacle Street, London, E.C.2. Some ten years after its foundation, the company developed the familiar chest-supported punch, which left the user's hands free. This punch rapidly achieved popularity and was eventually employed by the London General Omnibus Co. on all routes, and by other public transport companies in this country and abroad. The company started to produce tickets for use with the punches in 1891, and, today, its ticket works is said to be the largest of its kind in the world, with a daily output of many millions, printed on paper made in its own mills. After a disastrous fire, the Tabernacle Street works was rebuilt in 1895, but the further expansion of the company's business led to the need for more extensive manufacturing facilities, and the present site at Uxbridge was acquired during the first world war. Building at the new site started in 1919, and the transfer of production was completed in 1922.

In 1924, after the company had taken over Automaticket, Ltd., investigations were begun into the design and manufacture of ticket-issuing machines for all applications, and as a result mechanisms and equipment were developed which replaced those previously imported from the U.S.A. With the establishment of the Racecourse Betting Control Board in 1929, the company started to make totalisator ticket-issuing machines, which eventually were adopted as the standard type in this country. Bell Punch machines have also become standard equipment for the American Totalisator Company—the largest organization in this field in the U.S.A.—and, up to the present time, more than 5,000 machines have been supplied to the American company, Bell Punch equipment being used on 98 per cent of the racecourses in the U.S.A.

At one time, all taximeters used in this country were imported, but about 1930, the Bell Punch Company acquired the Waddington Tamperproof Taximeter Co., Ltd., which had started to make such equipment on a small scale, and taximeters have been produced by the company since that time. At a later date, the company needed a small adding mechanism for use in connection with its ticket-control systems, and acquired the manufacturing rights of an adding mechanism which had been developed by Petters, Ltd. The production of the small Plus adding machine was then initiated, and tens of thousands of these machines have now been sold in home and overseas markets. From this machine, a full keyboard calculating machine was developed, which was introduced in 1940 as the Sumlock, and the production of various

types of calculating machines now forms a very important part of the company's activities.

During the second world war, in collaboration with the Admiralty and the Royal Aircraft Establishment, Farnborough, the company designed, developed and manufactured a number of instruments, including the air position indicator, used by pathfinder aircraft, the torpedo director for torpedo-carrying aircraft, the fall of shot indicator, target bearing indicator and Pelorous sighting gear for warships, and the corrector compass coil which was applied to all ships fitted with degaussing equipment.

The Bell Punch Co., Ltd., now operates factories at Uxbridge and Portsmouth, which have floor areas of 193,000 and 11,000 sq. ft. respectively. The total number of people employed in the Uxbridge plant, which includes the large printing works, is 1,100, and from 850 to 900 staff and workpeople are occupied in the engineering division. The Portsmouth factory is engaged solely in engineering, being virtually self-contained with machine tools, assembly plant, and equipment, and employing 75 workpeople. There is a world-wide selling organization for the firm's products, with subsidiary companies in the U.S.A., New Zealand, and France.

At the present time, in addition to their punches, totaliser equipment and taximeters, the Bell Punch Co. make portable and other types of ticket-issuing and receipting machines, including automatic printing types; hand- and electrically-operated adding and calculating machines; and aircraft instruments. In all, 20 different products are made at the Uxbridge factory, some in batches of as few as 15 units, whereas others are required in very large quantities. Sales requirements and the intricacy of the various products are such that a total of 16,000 to 17,000 different components is used, this figure including bought-out parts. In a typical 3-month period, some 11,000 to 12,000 different types of parts are produced in the main machine shop, where about 200 operators are employed.

As has already been intimated, the components are made in batches, and the company's tooling and manufacturing procedures have been developed to afford a marked degree of flexibility, with the necessarily high standards of accuracy and finish. An extensive range of metal-cutting and metal-forming processes is employed, and, as will be made evident later, the company has fostered an open-minded approach to production problems, with the result that, in many instances, machines are used in a somewhat unconventional manner, if the required standards can best be achieved and maintained in that way.

MILLING COMPONENTS FOR AIRCRAFT INSTRUMENTS

The aircraft instruments that are included in the company's range of products are produced in limited quantities, so that the use of elaborate tooling equipment is not warranted. Many of the components are machined from small aluminium alloy drop forgings and castings, and their overall dimensions fall within a fairly narrow size-range, although they differ somewhat in shape. One of the machining stages on these components provides for milling groups of bosses and facings, and to hold the workpieces during such milling operations the company has developed a "universal fixture," which is shown in Fig. 1 mounted on the table of an Adcock & Shipley 2VE vertical milling machine provided with automatic control for the traverse movements.

The equipment incorporates two Eclipse permanent-magnet chucks, each measuring 14 by 6 in., which are secured to a baseplate with their long edges abutting. This baseplate is clamped to the table of the milling machine. A range of work-supporting and clamping units has been designed and built, and each unit has a flat, steel, base-member, so that it can be mounted on the surfaces of the chucks, and locked in position by magnetic forces. The set-up in Fig. 1 is for a forged aluminium workpiece *A*, but is representative of those for other components, some of which are seen in the foreground. A second workpiece is indicated at *B* in the machining position. Here, it rests on three dome-ended pillars, which project upwards from the base-member of the support unit *C*. Each pillar is threaded, and its height can be adjusted to compensate for slight variations between the forgings of different batches, so as to bring the top face of the workpiece parallel with the surface of the machine table. In the cross-wise direction, the workpiece is located by two stop-screws, which contact the flange at one side of the forging.

In order to hold the workpiece without distortion, it is gripped by four hardened centres with sharp, 60-deg. points. The cone points of two of the centre-units, one of which is indicated at *D*, are provided with screw adjustment. At the start of the operations on a batch of workpieces, these points are adjusted so that they engage the side of a workpiece. Each is then clamped in position by means of a lever-operated screw, as indicated at *E*, which closes a split bearing.

The other centre-units are of a somewhat similar design, but their cone points are coupled to the pistons of small (slave) hydraulic cylinders, one of which may be seen at *F*. These slave cylinders are connected by flexible piping to a

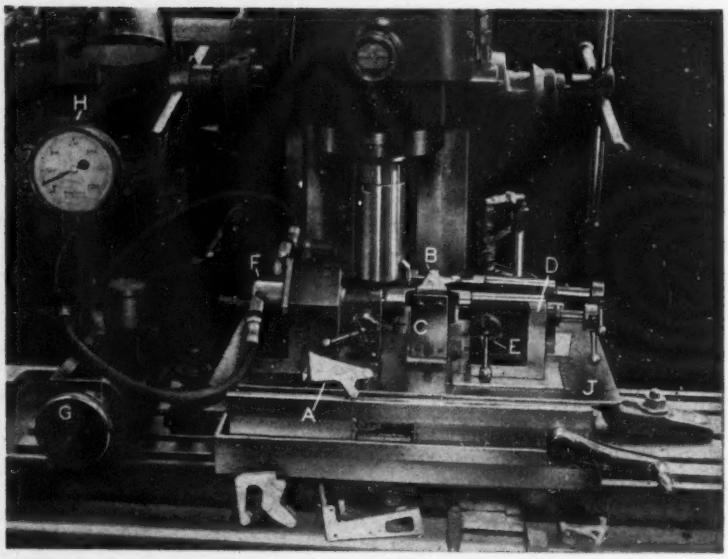


Fig. 1. This Universal Fixture has been Developed for Holding Small Aluminium-alloy Forgings and Castings During Face-milling Operations. The Various Fixture Members can be Arranged in Different Combinations on Two Magnetic Chucks, with the Aid of Templates, and the Workpieces are Clamped Hydraulically

master hydraulic cylinder in the unit at the left-hand end of the machine table, and it may be noted that both the master and slave cylinders are standard Girling brake units. The ram of the master cylinder is fitted to a screw, and is advanced by turning the knurled knob *G*. In this way, pressure is transmitted to the slave cylinders, and the cone points associated with them are thrust to the right (as viewed in Fig. 1), so that the workpiece is gripped between these points and those of the centre-units at the right-hand end of the equipment. Since the forgings are of a somewhat delicate nature, the knob *G* is turned only until a certain pre-determined pressure is registered on the gauge *H*. This pressure is determined by trial and is such that, although the workpiece is securely gripped, it is not distorted. When this pressure has been applied, the cone points of the left-hand units are locked in position by transverse clamping screws, similar to that at *E*.

Attention may be drawn to the levers for the clamping screws, also for the adjusting screws for the right-hand centre-units. Each lever is of the double-ball type, and its smaller ball-end is seated at the intersection of two grooves, at 90 deg. to each other, machined in the large head of the associated clamping screw. The metal around this intersection is peened over to retain the ball-end of the lever, but the arrangement is such that the lever can be swung outwards and engaged with any one of the four half-grooves. Thus, the lever can be set in the most convenient position for making adjustments or locking, and when this operation has been completed, can be swung downwards into such a position that it is clear of the cutter.

The equipment that has been described is used for machining 41 different components. To facilitate setting, a series of brass templates has been made, one of which may be seen at *J*. Each template has openings to locate the centre-units and the work-supports in their correct positions, before the magnetic chucks are energized. The ease with which setting-up can be accomplished is indicated by the fact that only 1½ min. was required to to dismantle the previous set-up, clean off the chucks, and re-arrange the equipment as shown in Fig. 1, ready for milling the workpiece *A*. Fly-cutting is employed for this component, and others of a similar type, and the machine spindle is run at 2,800 r.p.m. The tool is tungsten-carbide tipped, and the tip is set at a radius of 1⅛ in. from the spindle axis. From $\frac{3}{64}$ to $\frac{1}{16}$ in. of metal is removed, and the feed rate is 7½ in. per min.

MILLING INSTRUMENT FRAME CASTINGS

Fly-cutting is also employed to finish, at one pass, the principal faces of the aluminium castings which form the main frames of one of the aircraft instruments made by the company. One of these frames may be seen in Fig. 2, set-up on an Archdale 18-in. vertical milling machine, and the guards that normally enclose the working area have been

removed to allow details of the fixture to be observed. The frame casting rests on four dome-headed supports, which project upwards from the massive cast base of the fixture. One of these supports is fixed in position, and the stems of the other three are threaded, so that they can be adjusted, if necessary, to compensate for slight variations between the castings of different batches, to ensure that the cast face that is to be milled is parallel with the surface of the machine table. The large-diameter, knurled knobs for the adjustable supports are housed in pockets in the base of the fixture, as indicated at *K*, and they are locked by means of the knurled-head screw *L*, once they have been set in position. In addition to the supports mentioned, there are two spring-loaded supports, which are thrust downwards by the casting as it is loaded. These supports act as vibration dampers during machining, and are locked in position by knurled-head screws at the rear of the fixture. To avoid straining the casting, and to ensure a flat machined face, it is clamped between sliding and fixed knife-edge members.

There are two fixed knife-edges at the front of the fixture, as indicated at *M*, and at the right-hand end there are two knife-edges carried on sliding members provided with screw adjustment. One of these latter knife-edges is seen at *N*, and the positions of both are adjusted only as required to allow for differences in the castings, at the start of a fresh batch, and they are then locked in position. The casting is thrust against the knife-edges at the front and right-hand end of the fixture by pairs of movable knife-edges at the left-hand end and rear of the base. One of the units at the left-hand end of the base is indicated at *P*. The hardened steel blade is fitted to an L-shaped sliding member, that is free to move in a square-section guideway, machined in the base casting. It can be advanced and retracted by rotating the hand-knob at the left, and the hand-knobs for the other units at the rear of the fixture may also be seen.

A heavy flywheel-type body is employed to hold the fly-cutting tool. The latter has a tungsten carbide tip, which is set at a distance of 4 in. from the spindle axis. For the milling operation, the spindle is run at 888 r.p.m., and the machine table is advanced at a rate of 0·010 in. per rev.

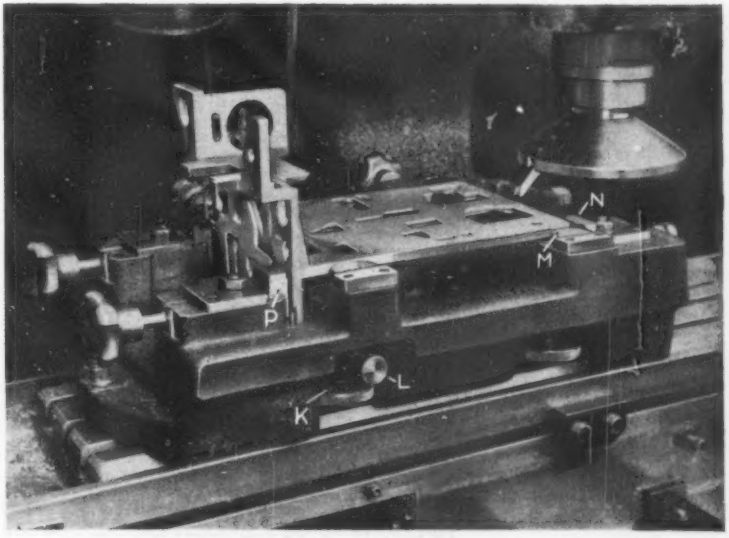


Fig. 2. At this Set-up for Fly-cutting the Main Surface of an Aluminium Casting for an Aircraft Instrument Frame, the Workpiece Rests on Adjustable Pads and is Supported by Spring-loaded Plungers to Damp-out Vibration. These Plungers are Locked in Position Before the Cutting Traverse is Initiated, and the Casting is Clamped between Fixed and Sliding Knife-edge Members to Avoid Distortion

MACHINING STEP CAMS FOR TOTALISATORS

Although the production of totalisator equipment is an important part of the company's activities, the demand for this equipment varies, so that it it not possible to machine the components in very large batches. In consequence, elaborate tooling equipment is not justified, and reliance is placed on skilled operators and the use of simple jigs and fixtures to achieve the required high standards of accuracy. A particularly interesting component is the step cam for the ticket-issuing machines of the totalisator. Step cams may be of four types, with either 10 or 12 steps, right- or left-hand, and examples of the 10-step design are

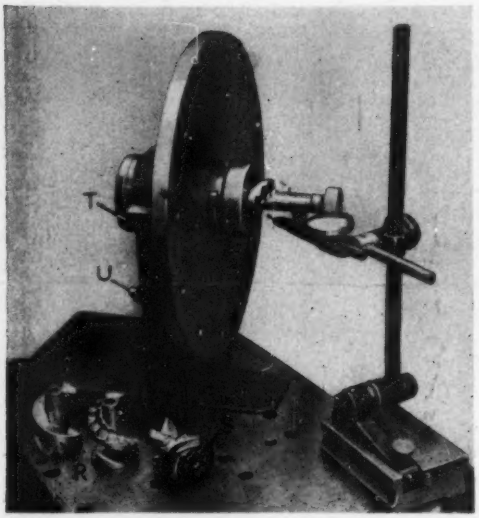


Fig. 3. Two Step-cams for a Totalisator Ticket-issuing Mechanism, and a Partly-machined Component, are Seen in the Foreground. The Cams may have Either 10 or 12 Steps, and the Checking Fixture at the Rear has a Replaceable Index Plate so that it may be Employed for Both Types

shown in Fig. 3. The cams are made from En.202 case-hardening mild steel, and a partially-machined blank is indicated at *R*.

The individual positions of the mutually-perpendicular step faces must be maintained within 0·002 in. lengthwise and ½ deg. angularly to the face and a datum slot *S* at one end, and the maximum allowable accumulative error in either direction is 0·002 in. Machining of the steps on the blank is carried out in two stages, 0·005 in. of metal being left on the form during the roughing operations, for removal at the finishing stage. The steps are milled on one cam at a time on an Archdale 18-in. vertical machine, and the set-up for a 10-step cam is shown in Fig. 4.

To hold and locate the workpieces, the company have designed and built a simple, special-purpose dividing head, seen at the left. This head has a flanged cast-iron body, which is accurately bored to receive a spindle, and is slotted at one side and provided with clamp screws so that wear can be taken up. At the right-hand end of the spindle (as viewed in Fig. 4) is mounted a work-support, which incorporates an arbor, and a removable location block. The cam blank to be machined is loaded on the arbor, and the datum slot is engaged with a key that is integral with the block. A nut is fitted to the screw thread on the end of the arbor to retain the cam blank, and the outboard end of the arbor is supported by means of a centre unit, as used with a conventional dividing head. The location block is held on the work-support by a screw and two dowels, and can

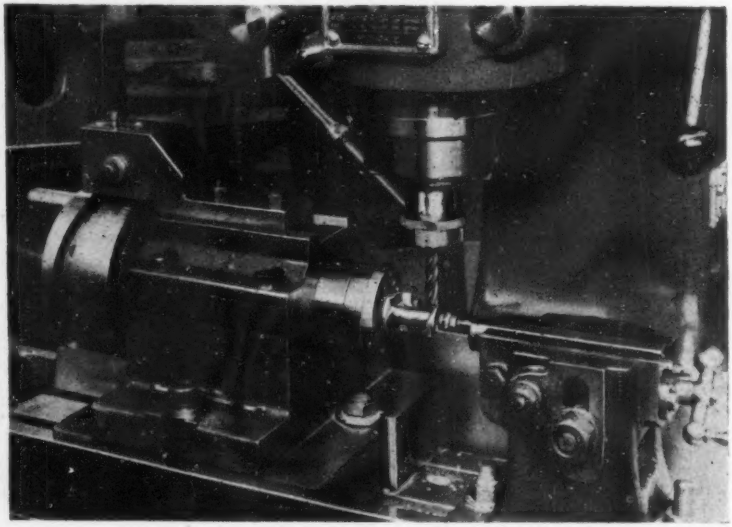


Fig. 4. This Set-up is Employed for Milling the Steps on Step-cams, and Incorporates a Special Dividing Head. There is a Replaceable Index Drum, with a Helical Groove which Moves the Work-spindle Lengthwise as it is Rotated between Successive Machining Positions, Final Location at Each Position Being Determined by a Hardened Bush

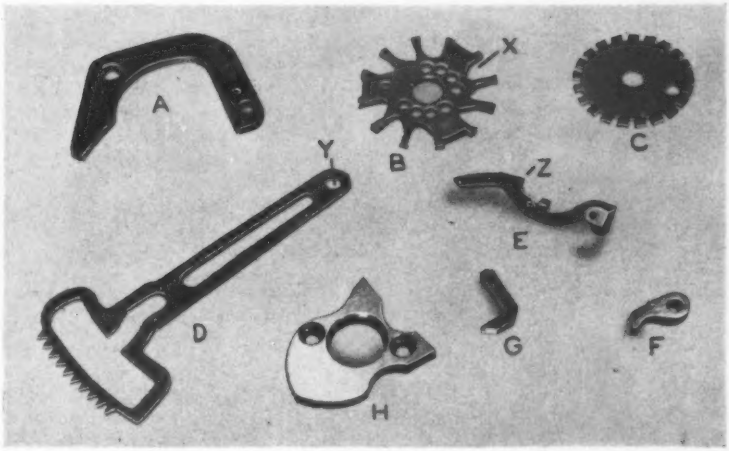


Fig. 5. A Group of Components on which Certain Portions have been Finished by Profile Engraving. This Procedure is Adopted where Close Limits and High-quality Surfaces are Specified, and the Parts Shown Include Components for Adding Machines, Taximeters and Aircraft Instruments

be mounted in a second position when 12-step cams are to be machined.

An indexing drum, for positioning the cam-blank before each step is milled, is fitted on the end of the spindle remote from the workpiece, and there is a 12-position drum in addition to the 10-position type shown. Each drum has the requisite number of holes, which are located at the bottom of a helical groove. The holes are fitted with hardened bushes, and are accurately bored to ensure that the workpiece is positioned angularly and longitudinally within the prescribed limits. A stout bracket, mounted on top of the dividing head body, houses a spring-loaded plunger, which is engaged with the bushed holes, in turn. During the rotation of the drum, between successive step-milling operations, the plunger contacts the side-walls of the helical groove, and the spindle is thus moved endwise, so that it is located approximately in the desired axial position when the next bush is beneath the plunger. Before each indexing movement, the plunger is withdrawn by means of a small lever on the far side of the bracket, this lever not being visible in Fig. 4.

Milling of the steps is carried out with an end milling cutter of $\frac{5}{16}$ in. diameter, which is run at a speed of 222 r.p.m., the table of the machine being fed by hand. With the equipment described, the time required for the roughing and finishing stages on a 10-step cam is 15 min. Soluble oil is employed as a coolant.

After milling, the radial positions of the steps are checked with a dial indicator gauge and the indexing fixture seen in Fig. 3. An accurately bored plate is screwed and dowelled to a spindle, which can rotate in a close-fitting hole in an angle-section base casting. Plates are available with 10 and 12 holes, and each workpiece is located correctly, with respect to the holes, by a peg which enters the datum slot *S*. It is clamped in position by a knurled nut on the end of the arbor which passes through its bore. At one side of the fixture, there is an accurately-positioned datum block *T*, and the dial indicator is set at zero with its stylus point in contact with the lower face of this block. Then, the stylus point is brought into contact with each radial step-face in succession, the plate and workpiece being indexed for each checking stage and located by the plunger *U*, which is engaged with each locating hole in turn.

After the inspection stage, the step cams are carburized and hardened. Small copper screws are inserted in the ten 6 B.A. tapped holes at the end of the component before the carburizing treatment, to ensure that the threads are left soft.

PROFILE ENGRAVING

The facilities of the milling section are supplemented by a well-equipped engraving department, where, in addition to the conventional engraving of figures, lettering, and other symbols, precision milling operations are carried out on very small components, under master-template control. Fig. 5 shows a group of components on which certain portions have been machined in this way, and this method is usually adopted when a smooth finish and close tolerances are specified, particularly on edges that would be inaccessible to a grinding wheel, for example.

Scrap views of the components are reproduced in Fig. 6, to various scales, and the surfaces that

H★

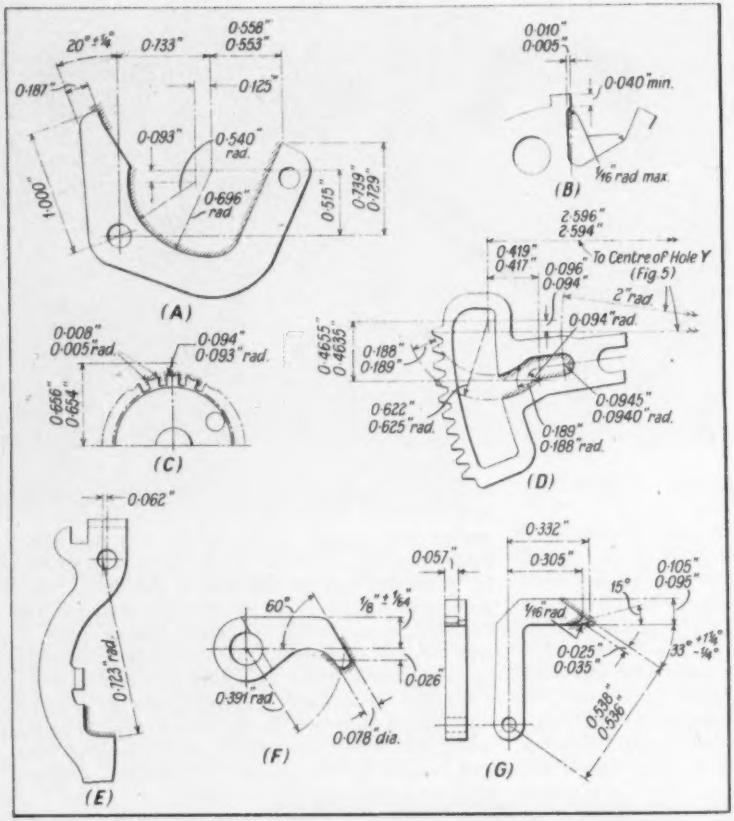


Fig. 6. Portions of the Components Seen in Fig. 5 that are Finished by Profile Engraving are Here Shown to Various Scales and Shaded. The Machined Forms are Maintained within the Required Limits of Accuracy by Means of Master Templates, and the Workpieces are Checked on an Optical Projector

are finished by profile engraving are shown shaded. An operating cam for a Sumlock calculating machine is indicated at *A* in Fig. 5 and 6, and is made from 13-s.w.g. (0·092 in. thick) En. 2 steel. An allowance of ±0·003 in. is specified for the dimensions indicated, unless otherwise stated. The $\frac{3}{16}$-in. diameter cutter employed is run at 1,900 r.p.m., and the time required for profile-engraving is about 3 min. The feed disc *B*, Fig. 5, is part of a taximeter mechanism, and is made from hard-temper En. 2 steel strip, of 16 s.w.g. (0·062/0·066 in. thick). It has 9 notches, as indicated at *X*, and the shape of each notch is shown more clearly in the scrap view *B*, Fig. 6. It may be mentioned that the corner, between the $\frac{1}{16}$-in. radius curve and the radial edge, must be sharp. For this component, the cutter, of ⅛ in. diameter, is run at 2,350 r.p.m., and the finishing operation on the nine notches is completed in about 10 min.

At *C* in Fig. 5 is shown a 21-tooth Geneva wheel for an aircraft instrument, and an enlarged view of the tooth-form is given at *C* in Fig. 6. The part is made from a bronze alloy, and the 0·093/0·094 in. and 0·005/0·008 in. radii at the crests of the teeth are finished on the engraving machine. In this instance, the ⅛-in. diameter cutter is run at 3,750 r.p.m., and the time required to finish all 21 teeth is about 4 min. A quadrant (decimal) for a Sumlock calculator, seen at *D* in Fig. 5, is made from 20 s.w.g. (0·035/0·037 in.) Jessops E.1 (3½ per cent nickel), or hard-temper En. 22, steel. The edges of the dog-leg slot are finished by profile engraving, as indicated in the scrap view *D*, Fig. 6. As may be observed, very close limits must be maintained on the slot form, and the location dimensions are given with reference to the hole *Y* Fig. 5. A cutter of ⅛ in. diameter is employed, and is run at 2,350 r.p.m., the time for the finishing operation being 1 min.

A roller latch for a Sumlock machine, seen at *E* in Fig. 5, is a complex pressing made from 0·8 per cent carbon spring steel (En. 42A), of 20 s.w.g. (0·0345/0·0375 in.) thick. This part is finished by profile engraving to ensure that the corner *Z* is sharp, and the machined surface is indicated by shading in the scrap view *C*, Fig. 6. A cutter of ⅛ in. diameter is used, and is run at 3,750 r.p.m., the time required for the finishing operation being approximately 15 sec. The pawl

seen at *F* in Fig. 5 is made from mild steel strip, ⅜ in. thick, and is part of a totalisator mechanism. Profile engraving is employed to finish the nose end, as in the view *F*, Fig. 6, since this portion of the edge must be smooth. With a ⅜ in. diameter cutter running at 2,350 r.p.m., this operation is completed in about 1 min.

The part *G*, Fig. 5, is a detent pawl for a Z.N. Numerator on a Tote ticket-issuing machine. In this instance, the work-material is 18 per cent nickel silver (hard or half-hard), and the thickness is 0·090/0·094 in. (13 s.w.g.). On the engraving machine, the nose end of the component is milled to a step form, as indicated in the scrap view *G*, Fig. 6, and all surfaces must be smoothly finished. The time required for the profile engraving operation is 2 min., and the cutter speed and diameter are the same as for the part *F* except that a single-edge tungsten-carbide cutter is used.

At *H* is indicated a 3-position control cam for a taximeter which is made from En. 33 case-hardening steel, containing 3 per cent nickel. This part is 0·123/0·127 in. thick, and is profile engraved all round the complex form. A cutter of $\frac{3}{8}$-in. diameter is used, which is run at 1,900 r.p.m. and the finished profile must be within a 0·010 in. tolerance envelope.

PROFILE ENGRAVING SET-UP

In Fig. 7 is shown the set-up for profile engraving the component indicated at *C* in Fig. 5, which is representative. An indexing fixture is employed, and the enlarged scale template, mounted on the carrier at the rear of the machine in the normal manner, has a track which corresponds to the form at the crest of one tooth. The indexing fixture has two main members, the base being secured to the machine table by toe clamps, and the work-support *J* being arranged to rotate freely on the base. There are two sets of holes in the base, each set being equally spaced on a pitch-circle that is concentric with the pivot for the work-support. One set provides for locating the support when the component under consideration is being machined, and the other set serves to locate the support for a similar workpiece with 20 teeth. A plunger *K* can slide in either of two bores in the work-support, so that it engages one or other set of holes in the base, to locate the workpiece correctly for each machining stage.

There is an annular groove in the work-support, to provide clearance for the engraving cutter, and the central spigot, enclosed by this groove, carries two pins, one of which is concentric with the work-support pivot. A workpiece is loaded so that its central bore passes over the concentric pin, and the other pin is engaged with the offset hole in the component (seen at the right in Fig. 5) to locate it in the correct angular position. The workpiece is secured to the fixture after it has been loaded or indexed by means of the air-operated unit at the front of the table. This unit incorporates a Pneu Pad PP2/1 which was supplied by Baldwin Instrument Co., Ltd., and a cranked clamp-member *L*. The outer end of the member *L* is attached to the moving plunger of the Pneu Pad, and is pivotally-mounted at an intermediate point by means of a spring, domed washer, and screw. At the inner, cranked end of the clamp-member, there is a flat projection whereby pressure is imparted to the workpiece, and a hole in this projection provides clearance for the central locating pin of the fixture. The arrangement is such that when air is applied to the Pneu Pad, the inner end of the clamp member holds the workpiece on the fixture, and when the air supply is cut off, the workpiece is released. A flexible pipe connects the Pneu Pad to a spring-loaded lever-operated valve mounted on the left-hand end of the table, and the lever of this valve is coupled by a rod to a pedal on the floor, in a convenient position for the operator. Thus, the operator's hands are left free, and he can guide the follower round the track in the master template with his left hand, and index the workpiece, after the clamp has been released, with

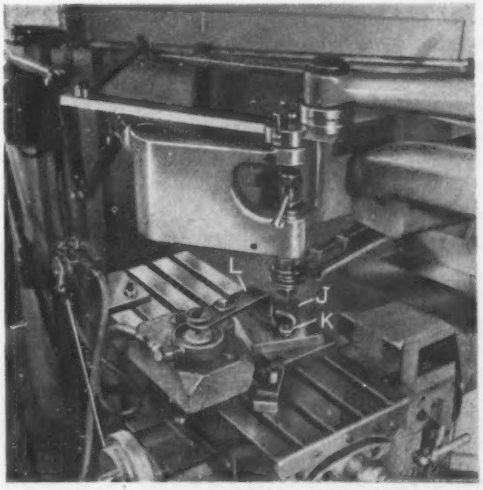


Fig. 7. Close-up View of the Deckel Machine Employed for Profile Engraving. Each Workpiece is Clamped by a Cranked Lever Coupled to a Pneu-Pad Air Cylinder, which is Controlled by a Lever-operated Valve Connected to a Pedal

his right hand. All surfaces that are finished by profile engraving are checked on an optical projector against large-scale master drawings.

AUTOMATIC TEMPLATE INDEXING EQUIPMENT

The Ultimate fare collection system is the most advanced in the range developed by the Bell Punch Co., Ltd., and an example of an Ultimate ticket-issuing machine is shown in the heading illustration. Ticket-blanks for this system are preprinted and supplied in rolls of 500 for loading into the machine, and, as each ticket is issued, up to five different items may be printed thereon. Issue of a ticket is effected by depressing one of the cylindrical knobs at the front of the machine, which may be carried by the operator or mounted in the vehicle that it serves. Items printed by this machine at the time of issue take the form of Roman numerals or letters, or other symbols, and the type is formed integral with the peripheries of die cast zinc-alloy discs, the finished components being known as printing wheels.

When the printing wheels are assembled in the Ultimate machine, the character in the printing position is at the bottom of the wheel—that is, at the "6 o'clock" setting. In order that the character may readily be indentified when adjustments have to be made, a sunk facet is machined in the periphery of the wheel, approximately opposite to each character, and on this facet a corresponding symbol is engraved, and subsequently filled with black paint. In the machine, the engraved symbol, associated with the character in the printing position, is set at "12 o'clock," and is readily visible to the user. Typical printing wheels, as die cast, and after the facets and symbols have been engraved, are shown in Fig. 8.

Since each item that is printed may consist of two symbols, and Ultimate machines are available with as many as six ticket printing and issuing units, it will be appreciated that printing wheels are required in substantial quantities. Both the machining of the facets and engraving of the symbols thereon are carried out on a Taylor, Taylor & Hobson pantograph machine, and to facilitate this work, the machine has been equipped with a pneumatically-actuated indexing arrangement for the enlarged-scale templates, which is interlocked with the indexing fixture for the workpieces.

Fig. 9 is a general view of the engraving machine. The template which controls the movement of the engraving cutter is indicated at *M*, and it will be seen that it is of circular form. Depending on the type of printing wheel that is being engraved, the template may have 8, 10 or 12 sunk characters, and is mounted on an index disc, which has the corresponding number of lobes and notches. At the right-hand side of the support for the indexing mechanism is pivoted a lever *N*, which carries a vertical roller that engages the notches in the index disc. The lever *N* is pulled towards the disc by the action of a tension spring, and is coupled to a pneumatic cylinder whereby it can be thrust outwards to release the disc. A ratchet wheel, of the pin type, is fitted below the support for the index disc, and the associated ratchet is actuated by a lever connected to the air cylinder mentioned. In order to reduce operator fatigue, a plywood support is mounted in front of the template and index disc, and the operator of the machine can rest her arm on this support while she guides the follower round the sunk characters in the template.

A close-up view of the indexing fixture employed to hold the workpiece is given in Fig. 10. The die cast blank is loaded on the horizontally-disposed spindle of the work-head at the left-hand side, and

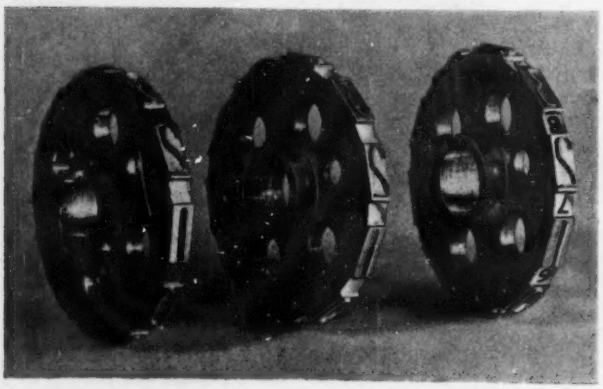


Fig. 8. Printing Wheels for Ultimate Ticket Issuing Machines are Die Cast in Zinc Alloy. The Printing Characters are Formed Integrally with the Periphery, and Facets and Symbols are Engraved Subsequently for Identification Purposes. A Die Cast Blank is Seen at the Left, and Wheels, with the Facets and Symbols Engraved, at the Right

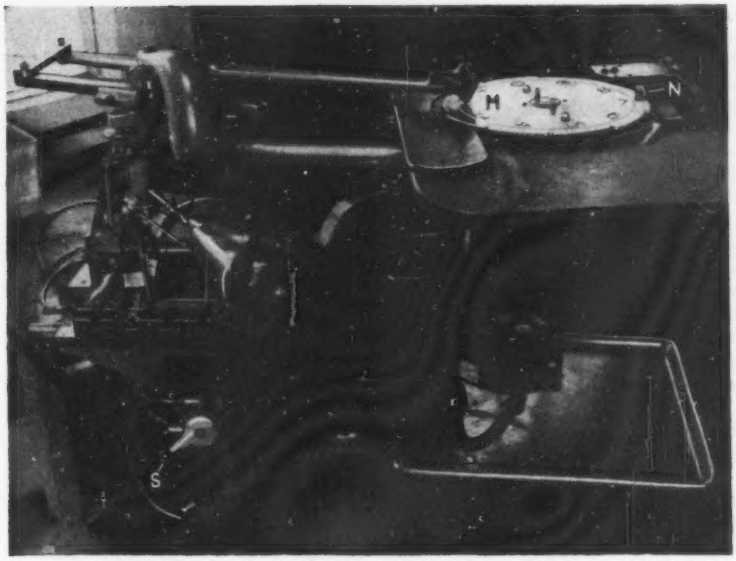


Fig. 9. General View of a Taylor, Taylor & Hobson Pantograph Engraving Machine Set Up for Engraving the Symbols on Printing Wheels. An Indexing Fixture for the Work is Mounted on the Machine Table, and is Interlocked with the Air-operated Indexing Mechanism for the Enlarged Template

is located by the bore and one of the die cast holes. It is clamped by the pusher *P*, which is free to rotate on the piston rod of the air cylinder *R*. This cylinder is controlled by the lever-actuated valve *S*, Fig. 9, which has two settings, one to advance, and the other to withdraw, the pusher. A peg-type ratchet wheel is mounted on the spindle of the work-head, and is engaged by a drag-pawl coupled to the lever *T*, Fig. 10.

Below the lever, at the rear of the work-head, there is a plunger valve which controls the air supply to the template-indexing mechanism. The arrangement is such that, by depressing the lever with her left hand, the operator can index the workpiece through the required angle. At the end of its movement, the lever trips the plunger valve, so that the next character on the circular template is brought into the operating position.

When the lever is released, it is returned by a spring, and the plunger valve resumes its original setting. Consequently, the air cylinder of the template indexing mechanism is connected to exhaust, and the template is locked in position by the roller on the lever *N*, Fig. 9, under the action of the associated spring. Exhaust air from the indexing cylinder is delivered to the cranked

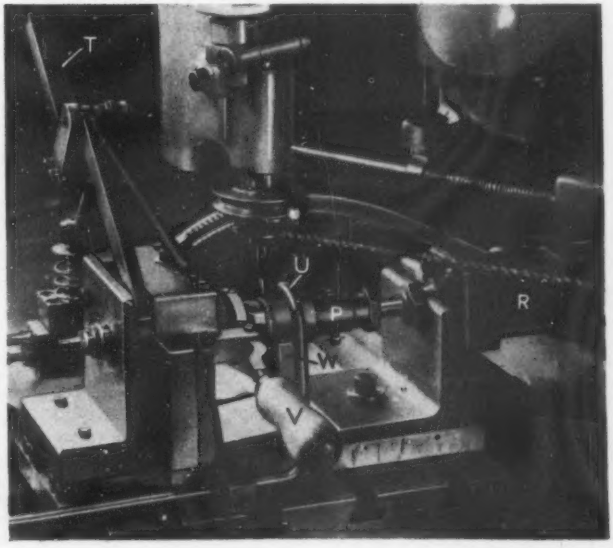


Fig. 10. Close-up View of the Indexing Fixture for Holding Printing Wheels while the Facets or Identification Symbols are Engraved. At the End of the Engraving Operation, the Workpieces are Ejected and are Delivered by a Chute into a Receptacle at the Rear of the Machine

pipe *U*, Fig. 10, whereby it is directed on to the workpiece and the location surfaces on the workhead spindle, in order to remove the fine swarf formed during the engraving operation.

When the facets or symbols on the workpiece have all been machined, the valve *S*, Fig. 9, is re-set, and the pusher *P* is withdrawn. Then, the workpiece is thrust off the locations on the spindle by an ejector fork, pivoted at the front of the fixture, the handle of the ejector being indicated at *V*. The workpiece falls into a chute *W*, whence it is directed to a box at the rear of the machine table. Facets and symbols are engraved on a printing wheel with ten characters in less than 3 min.

FINE-BORING SMALL HOLES

Certain of the mechanisms made by the Bell Punch Co., Ltd., incorporate numbers of gears which are produced to close tolerances. It is most important that these gears should run accurately, and careful attention is paid to machining of the bores concentric with the teeth. The bores of the gears are finished after the teeth have been cut, and in order that the workpieces may be located by their peripheries during the fine-boring stage, top-cutting hobs are employed. Some of the smaller gears are fine-bored on Pultra lathes, with their peripheries gripped in collet chucks, and to ensure that the boring tools are fed at a uniform rate, the lathes have been modified so that the tool-carrying slide on each is advanced by a cam.

A modified Pultra lathe is shown in Fig. 11, and, in this instance, the workpiece has a duralumin bush, the bore of which must be finished to 0·1560/0·1565 in. diameter. A workpiece may be seen in the collet chuck, and the collet is checked at the start of the machining operations on a batch of gears, and is re-bored if necessary, to ensure concentricity between the periphery and the bore of the component. The small single-point tool is mounted in a massive block, bolted to the compound slide, and the normal feed-screw and ball-handle for the slide have been removed. A length of rod with a thread at the outer end is secured to the swivel-base for the slide, and passes through a hole in the end plate fitted thereto. The rod supports a compression spring to urge the slide away from the headstock of the lathe, and the movement is limited by nuts on the threaded end of the rod, as indicated at *A*.

The slide end plate carries a vertical shouldered screw and roller *B*, and this roller engages the periphery of a cam *C*. This cam is mounted on the lower end of the vertically-disposed output shaft of a reduction gearbox integral with the f.h.p. motor *D*, which is supported on a bracket at the end of the machine bed. When the motor is running, the output shaft and cam are driven at a speed of 4·2 r.p.m., and the design of the cam is such that the tool is advanced and withdrawn at a traverse rate of 0·001 in. per rev., the work being run at a speed of approximately 2,000 r.p.m.

REAMING SET-UP ON A TAPPING MACHINE

It has already been pointed out that the company may employ a machine for a purpose other than that for which it was originally intended, if

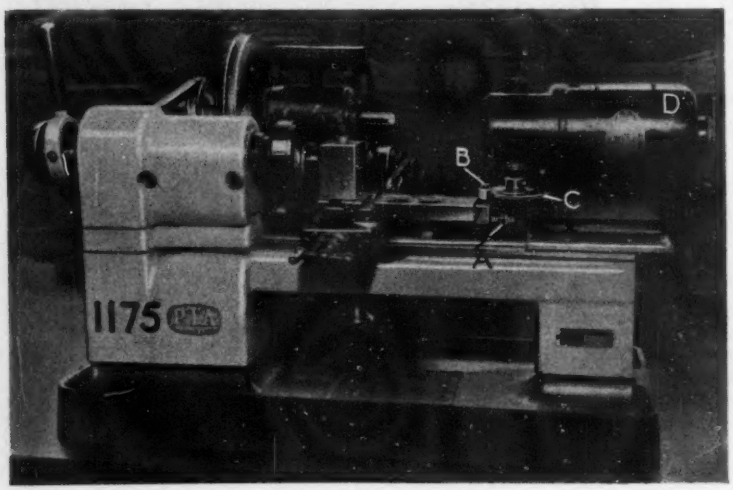


Fig. 11. This Pultra Lathe is Employed for Fine-boring the Holes in the Bushes Fitted to Small Gears. The Lathe has been Modified so that the Tool-carrying Slide is Advanced by a Cam, Driven by an F.H.P. Motor and Reduction Gearbox, Mounted on the End of the Bed, to Ensure that the Tool is Fed at a Uniform Rate

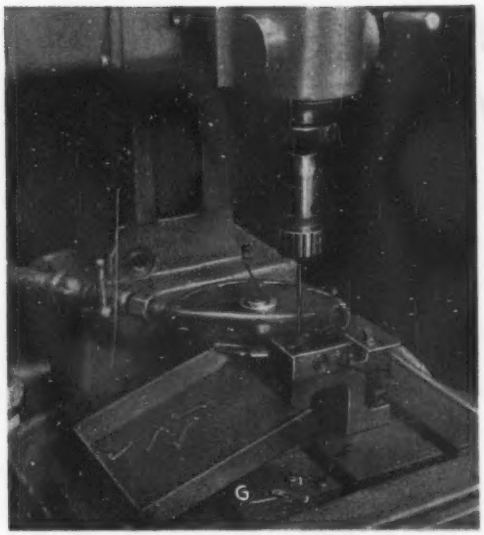


Fig. 12. Since it has Provision for Feeding the Tool at an Accurately-controlled Rate, a Hüller Tapping Machine is Employed for Reaming the Holes in Small Pressings, and is Fitted with a Simple, Manually-operated Indexing Fixture

the standards of accuracy and finish can best be achieved in this manner. A good example of this somewhat unorthodox approach is afforded by the use of a Hüller tapping machine for a reaming operation, whereby the holes in certain small pressings are finished. The tapping machine is employed because a controlled feed rate is essential to maintain hole size and finish. Finished sizes of the holes in the pressings range from 0·093 to 0·125 in., and 0·004 in. of metal (a side) is removed at the reaming stage. A spindle speed of 700 r.p.m. is used, and the feed mechanism of the machine is set for tapping a 6 B.A. thread, so that it advances the tool at a rate of 0·021 in. per rev.

A close-up view of the Hüller machine is shown in Fig. 12, and, as may be observed, it is equipped with a simple indexing fixture, which incorporates a replaceable nest plate *E*. The nest plate has ten apertures to hold the workpieces, one of which is seen at *F*. A range of nest plates are available to suit the different pressings that are reamed on the machine, and one of the smallest of these pressings may be seen at *G*. At the right-hand side of the fixture, there is a projecting platform, the surface of which lies in the same plane as the top face of the fixture body. Workpieces are inserted in each aperture, in turn, when it is above the platform, and, as the plate *E* is indexed, the workpiece slides across the platform and the top face of the fixture base to a position beneath the guide bush in the block *H*. This block houses a spring-loaded detent plunger which engages V-shaped notches in the nest plate to locate each workpiece initially, but clearance is provided in each nest to allow the pressing to be aligned, finally, by the reamer. Since there is a hole at each end of the pressing, there are two notches for each nest.

The operator loads pressings with her right hand and indexes the plate with her left hand, and, to facilitate alignment of the notches with the detent plunger, radial lines are scribed on the surface of the nest plate. With the plunger engaged with a notch, the downward feed of the tapping machine spindle is initiated by means of a foot-operated clutch. After the tool has been withdrawn at the end of the reaming operation on the second hole in each pressing, the nest plate is indexed to bring another workpiece into the reaming position, and the pressing that has just been reamed drops through the aperture in the nest plate into the tray at the left-hand side, as it moves clear of the fixture base.

Further interesting set-ups and equipment for the production of calculating and other machines at the Uxbridge works of the Bell Punch Co., Ltd., will be considered in subsequent articles in this series to be published shortly in MACHINERY.

ROLLING STRIP FROM METAL POWDER.—Reference is made in *Mechanical Engineering* to a rolling mill developed by Stanat Mfg. Co., Westbury, N.Y., for producing strip material from metal powders. Normally, it is employed with the rolls side by side, but can also be converted into a vertical 2-high/4-high mill. Rolls of different diameters and lengths can be fitted, and the normal range covers strip widths up to 7 in. and thicknesses from $\frac{1}{32}$ to $\frac{1}{8}$ in.

Both ferrous and non-ferrous powders can be rolled cold or hot, and for the latter purpose the rolls are of heat-resistant steel and are equipped with electric cartridge elements. Powder is fed between the rolls and compacted into a solid uniform mass which is subsequently sintered. Uniform delivery is ensured by the use of hoppers and vibrators. It is stated that laminated materials can be obtained by feeding two or more powder streams simultaneously. In addition, it is possible to obtain a "sandwich product" by compacting a powder between two metal strips.

Further Developments in Tools with "Throw-away" Tips

Consequent upon the increasing adoption of "throw-away" tip type tooling, there have been considerable developments in methods employed for holding the inserts. Several examples of commercially-available tool-holders for mechanically-clamped tips were given in an article published in MACHINERY (87/1199—18/11/55), but, in this instance, lathe tools only were discussed. The field of application for such tooling has now widened, and the present article includes details of "throw-away" tip cutters used for milling, also for boring and trepanning, as well as further examples of lathe tools.

One of the major advances of loose tips is that they can be indexed in the holder, and full use can be made of all the cutting edges provided by their geometric forms. Furthermore, if the insert is designed for negative rake cutting, it can be inverted, as well as indexed, and the number of available cutting edges is thus doubled. It follows, therefore, that if these tools are to be exploited to the full, the method of holding must be such that the tip can be indexed, or inverted, rapidly and easily, and most of the designs discussed in this article have been developed for that purpose.

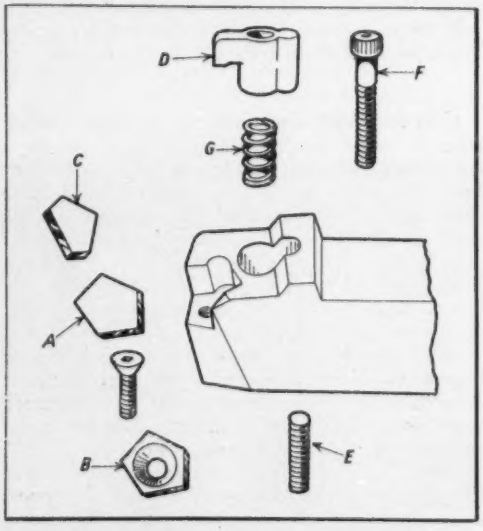


Fig. 1. The Wil-Dex Design of Tool-holder, in which the Heel of the Clamp is Supported on an Adjustable Screw

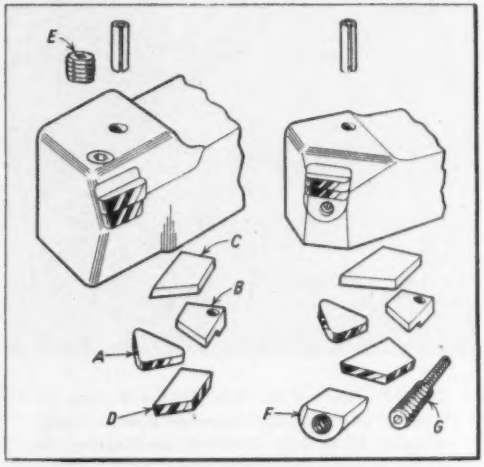


Fig. 2. In these Two Designs of Tool-holder, Made by the Viking Tool Co., the Tip and its Seating are Housed in a Broached Slot in the Holder. For the Holder Seen at the Left a Plain Clamping Screw is Employed and for that at the Right, a Wedge and Differential Screw

The Wil-Dex tool-holder shown in Fig. 1 is marketed by Willey's Carbide Co., U.S.A., and in this design the clamping piece *D* is provided with a part-cylindrical body portion which locates in a hole bored in the holder. A semi-circular heel on the clamp engages a similarly-formed recess in the body of the holder, to prevent rotation of the clamp when the locking screw *F* is tightened. The heel of the clamp is supported by the screw *E*, which engages a tapped hole in the shank, and can be adjusted to set the height of the clamp for tips of different thicknesses, also to make allowance for the inclusion of a chip-breaker. A compression spring surrounding the screw *F* raises the clamp, to facilitate indexing the insert. The shim *B* is secured to the tool-shank by a countersunk head screw, to provide a seating for the

pentagonal tip *A*, and the carbide chip-breaker indicated at *C* is available in a range of widths.

A feature of the tool-holders shown in Fig. 2, which are made by the Viking Tool Co., U.S.A., is that the tip, and its locating and clamping plates, are housed within a slot broached in the shank. This company's Utiladex holder for triangular or square tips, arranged for negative or positive rake cutting, is shown at the left, and it will be seen that the tip is positioned against a step formed on the locating piece *B*. The carbide seating is indicated at *D*, and the tip is clamped between this member and the chip-breaker *C* by means of the screw *E*. It is arranged that the sides of the locating piece *B* are a good fit in the broached slot, and this part is finally positioned by a split dowel (seen adjacent to the clamping screw), which registers in a reamed hole in the tool-holder body. The Viking Supradex holder, at the right in Fig. 2, is basically similar in design, but in this case the tip, seating, and chip-breaker assembly is clamped in position by means of the tapered, semi-cylindrical wedge *F*, and the twin-thread screw *G*. A split dowel is again used for positioning the stepped locating plate.

A serrated heel-seating *D* is brazed in position on the tool-holder seen in Fig. 3, which has been developed by the Valenite Metals Division of the Valeron Corporation, U.S.A. The clamp *B* has a notched heel which engages with these serrations, and an elongated hole is provided to receive the clamping screw *A*. This arrangement allows the clamp to be adjusted in an end-wise direction for setting the chip-breaker *C* relative to the cutting edge of the tool. The chip-breaker is pinned to the clamping piece, so that it is retained in position when the latter is loosened and raised.

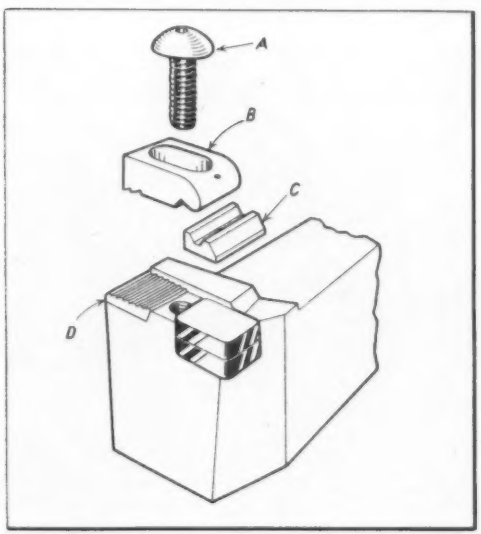


Fig. 3. The Valenite Tool-holder here Shown has a Serrated Seating for the Heel of the Clamp, which Allows the Clamp and Chip-breaker to be Adjusted Relative to the Cutting Edge

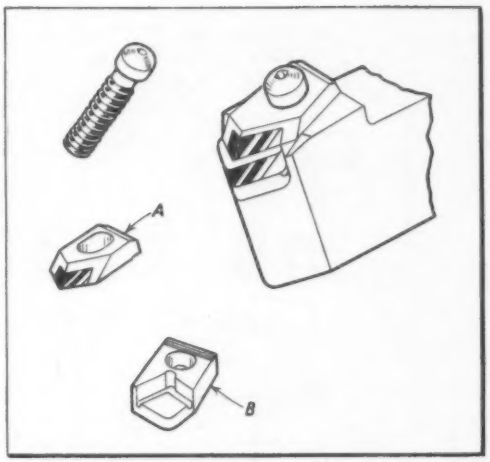


Fig. 4. A Wesson Multi-cut Single-point Tool-holder in which the Serrations for Locating the Heel of the Clamp are Formed in the Tip-seating

Another tool-holder which provides a positional adjustment for the chip-breaker, relative to the insert, is made by the Wesson Co., U.S.A., and is shown in Fig. 4. Here, a notch on the heel of the combined clamp and chip-breaker *A* engages one of a number of serrations in the seating *B*, and the tip is clamped between these two pieces. In this design, it will be noted, the carbide chip-breaker is, in itself, an insert, which is brazed into the clamping piece. A range of seatings with differently-pitched serrations is available, to suit tools of different sizes.

As a final example of a conventional lathe tool, with throw-away tip, reference is made to Fig. 5. This tool, which is manufactured by the Metallurgical Products Department of General Electric Co., provides a tungsten-carbide seating *A*, secured to the tool-holder by a countersunk screw, and the location for this member, and the tip, is taken from a seating in the shank. The carbide-faced combined chip-breaker and clamping piece *B* has a cylindrical portion, the outside of which registers in a bored hole in the tool-holder, while the inside is threaded to receive the upper portion

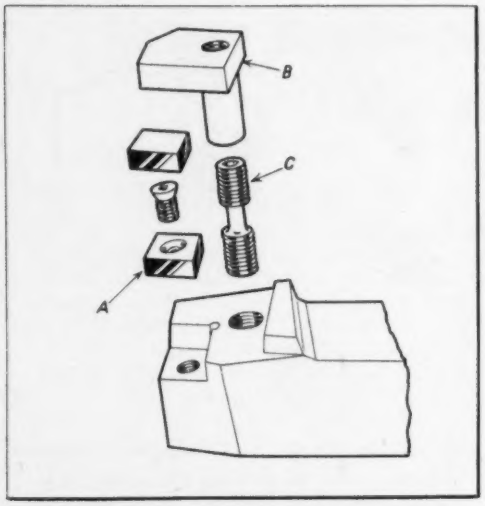


Fig. 5. In this Carboloy Design of Tool-holder, a Differential Screw is Used for Clamping the Tip, and Raising the Clamp, Positively, for Indexing

of the twin-threaded clamping screw *C*. Socket-head recesses are provided at each end of this screw, and the lower threaded portion engages a tapped hole in the body of the tool-holder. It will be noted that the clamp *B* is prevented from rotating by its flat rear face, which engages a step on the holder. When the screw *C* is loosened, the differential thread ensures that the clamp is raised positively, thereby facilitating indexing or inverting the tip.

An unusual example of the application of throw-away tips is afforded by the twin-grooving tools seen in Fig. 6. In this holder, which was made by Modco Tools, two tips are employed, mounted on edge. Designed for grooving transmission shafts for motor car engines, the tips were ground to the required width, the corners were left sharp, and each was retained in the holder by a simple clamping piece. It is claimed that this tool effected a considerable saving in time, since, when the cutting edges were worn, it was necessary to index the tips only, instead of replacing and adjusting the entire holder.

MILLING CUTTERS WITH THROW-AWAY TIPS

Since the grinding of milling cutters presents more problems than the sharpening of single-point lathe tools, the former offer many opportunities for the use of indexable throw-away tips. If accurate locations are provided, the inserts can be indexed or inverted without removing the cutter from the spindle, and, by substituting tips of a different grade, the same cutter body can be employed for machining various types of material.

In Fig. 7 can be seen the method of locating and clamping employed on cutters made by the Wesson Co., U.S.A., and it will be noted that both are effected by the wedge-piece *B*. This part has a step at the rear, for positioning the back of the tip, and a recess in the 15 deg. tapered face, to engage the head of the clamping screw *A*. The top edge of the wedge is slightly concave, to assist in swarf clearance, and it is claimed that this design of cutter is suitable for high-speed milling at rapid feed rates. A somewhat similar method of clamping is used for the cutter shown in Fig. 8, which is manufactured by Futermill, Inc., but in this design the tapered wedge is fitted behind the tip, and is drawn into the cutter body by the cap screw *B*, which passes through a clearance hole in its centre. The tip is located by a seating formed in the cutter body. A grub-screw *A* is provided for locking the screw *B*, and the hexagon socket in the former is larger enough to pass the clamping key for the latter.

A feature of the Super-Jack tip-clamping method used by McCrosky Tool Corporation is that no tapped holes are required in the body of the

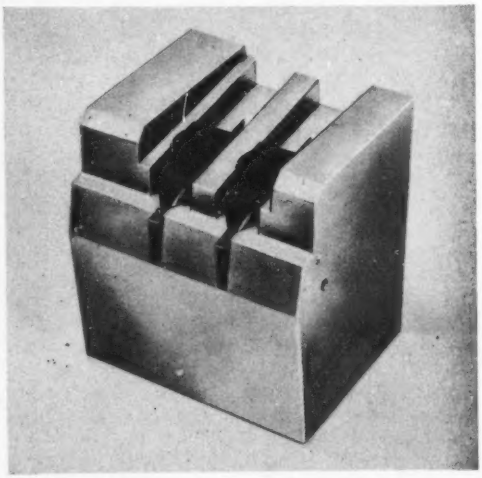


Fig. 6. This Modco Grooving Tool is an Unusual Application of Throw-away Tips. Two Inserts, Ground to the Required Width, and with the Corners left Sharp, are Mounted on Edge

cutter. As may be seen in Fig. 9, there is a self-contained clamping unit *A*, comprising two wedge members of cylindrical form joined by a clamping screw, which passes through a clearance hole in the upper member, and engages a tapped hole in the lower. This self-contained assembly fits in a hole bored in the cutter body, and is seen in position in the part-sectional view included in Fig. 9. When the clamping screw is tightened, the upper wedge piece is depressed, and, by abutting the cutter body, forces the lower wedge to the right, to clamp the chip-breaker *B* and the tip. It will be noted from the sectional view that the cutter body is made in two parts, and this method was adopted so that the locating faces for the tips could be ground more easily. In addition to the absence of tapped holes in the cutter body, a further advantage is claimed in that, with this design, the clamping force is exerted in the horizontal plane only, and no pressure is imposed on the bottom of the recess.

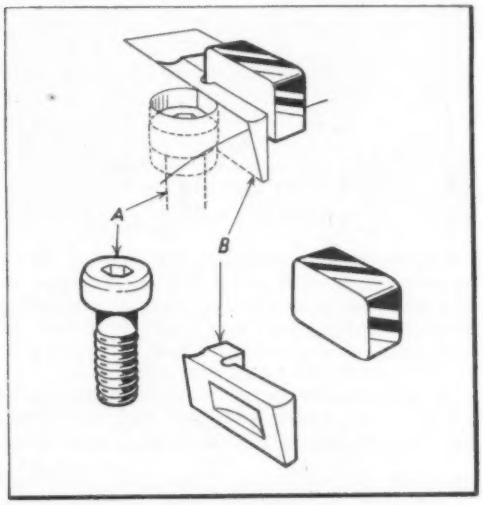


Fig. 7. The Clamping Method Employed for Wesson Milling Cutters Fitted with Throw-away Tips. The Tip is Held by a Combined Clamping and Locating Wedge, Drawn into the Cutter-body by a Single Screw

Another design of cutter which incorporates a two-piece body is that made by Newcomer Products Inc., and a perspective view of the tip locating and clamping arrangements is given in Fig. 10. This cutter incorporates the normal

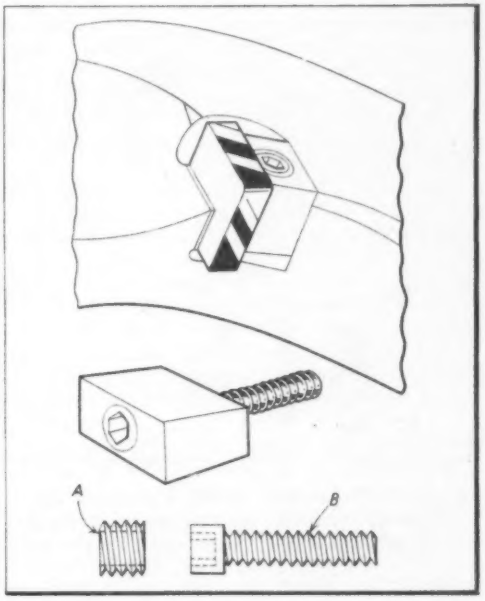


Fig. 8. A Wedge is also Used for Clamping the Inserts in Futurmill Inc. Cutters, but in this Design the Wedge is Located Behind the Tip

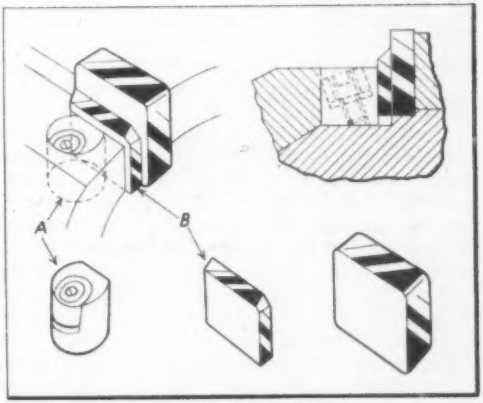


Fig. 9. A Feature of the Super-Jack Tip-clamping Employed for McCrosky Milling Cutters is that no Tapped Holes are Required in the Cutter Body. The Cutter is Made in Two Concentric Pieces, to Facilitate Grinding the Tip Locations

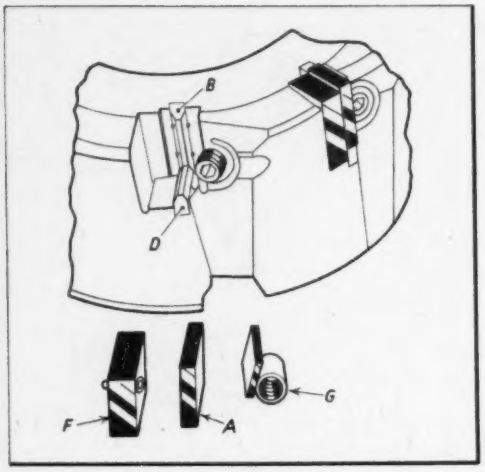


Fig. 10. Newcomer Milling Cutters are also Made in Two Pieces, and Location for the Tip is Provided by Carbide "Knife-edges" Let into the Cutter Body

carbide seating *F*, and clamp and clamp-plate *G*, but the design is such that the tip *A* is supported and located by the carbide strips *B* and *D* only, and has no contact with the cutter body. The strip *B* is carried in the inner portion of the body, and the strip *D* in the outer, and the locating edge of each is ground to a vee, with a narrow land at the apex. These strips offer the advantage of a positive and accurate location for the tip, in conjunction with high wear-resisting properties.

The 12-in. diameter face-mill shown in Fig. 11 consists of a steel body portion, with eight parallel gashes milled in the periphery to receive Kendex single-point tool-holders with square, turn-over inserts. It is arranged that the top face of each tool-holder lies on a plane which passes through the centre of the cutter body, and details of the locating and clamping arrangements for the tip on the Kendex tool-holder were given in the previous article, already mentioned.

Each holder is clamped by a pair of cap screws, the counterbores for which can be seen in the illustration. A number of these cutters was made in the tool-room of a large manufacturer of agricultural machinery in the U.S.A., and they are employed for milling 8½-in. long by 12½-in. wide faces on a cast iron transmission housing. The cut, which varies in depth from $\frac{1}{16}$ to $\frac{5}{32}$ in., is taken at 320 surface feet per min., with a feed rate of 4½ in. per min., and the face is machined in one pass. It has been found, in practice, that between 50 and 60 parts can be machined before the tips require to be indexed, and, as each tip has eight cutting edges, from 400 to 480 parts can be completed before new inserts are required. The time needed for indexing the eight tips is 20 min. Previously, a 3-in. diameter high-speed steel end-mill was used for this operation, and the time taken was more than double that required with the new method. Furthermore, the high-speed steel cutter would machine only 25 parts before it required sharpening, and the average time required for this operation was 1½ hours.

For producing parts of their F-102A airplane, the Convair Division of General Dynamics Corporation, U.S.A., have adopted throw-away tip tooling for all the turning and facing operations involved, as well as for 60 per cent of the face-milling required. It has been found, in practice, that tips for milling cutters should be provided with chamfered, rather than radiused, corners, as less heat is then generated. The cutting speeds employed by this company, when using throw-away tip tools, vary from 200 ft. per min., for titanium alloys, to 800 ft. per min., for certain other temperature-resistant materials, and for machining aluminium the speed, in general, is limited only by the design of the machine.

A typical milling operation is shown in Fig. 12, where a Vascoloy-Ramet cutter, with five, square tips, is seen milling SAE 4130 steel at a surface

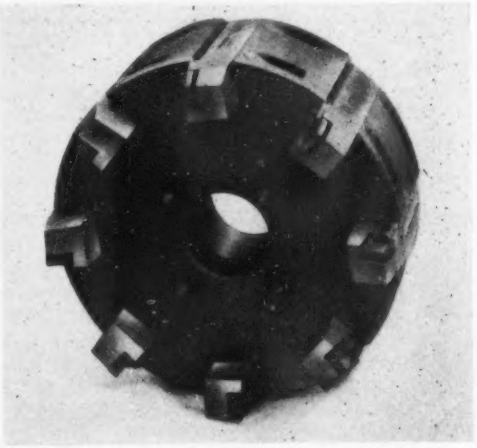


Fig. 11. A Face-milling Cutter Built-up from Eight Standard Kendex Single-point Tool-holders Clamped in a Steel Body. Each Tool-holder has a Square, Indexable Tip

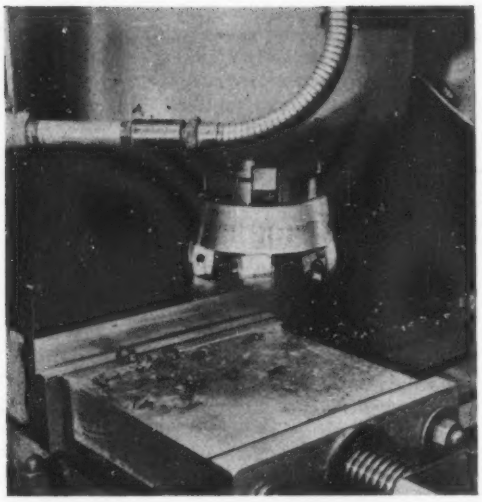


Fig. 12. In this Typical Milling Operation, a 5-tipped Vascoloy-Ramet Cutter is Shown taking a ¼-in. Deep Cut, in SAE 4130 Steel, at a Surface Speed of 270 ft. per min.

speed of 270 ft. per min., and a depth of cut of ¼ in. The method employed for holding the tips on this cutter is similar to that already described in MACHINERY.

BORING TOOLS WITH THROW-AWAY TIPS

Throw-away tips can also be used for boring operations, and various suitably-designed boring tools are now commercially available. As an example of the economies which can be effected by adopting this method of tooling, it may be noted that in a motor car plant in the U.S.A., the cost of boring 8-in. diameter holes, through clutch plates of ¾-in. thick steel, has been reduced to one-quarter of that involved when using brazed tools. With the latter, regrinding of the tool was necessary after 12 plates had been bored, and when a total of 96 had been completed, the tool was no longer serviceable. For comparison, 31 plates are now bored with each cutting edge of the throw-away tip, and, as the tip has eight cutting edges, 248 parts are bored before a fresh tip is required. Apart from the increased output per tip, further savings resulted from the elimination of re-grinding operations, and the small amount of time required for indexing the tip as compared with that required for removing the brazed tool from the machine, and the subsequent re-setting after sharpening. It is interesting to note that with both types of tooling the cutting speed, feed rate, and depth of cut were the same, namely 280 ft. per min., 0·011 in. per rev., and $\frac{7}{16}$ in., respectively.

The boring bar shown in Fig. 13 is made by the Modco Tools Division of the Valeron Corporation, U.S.A., and incorporates two Valenite micro-adjustable boring units, each fitted with a positive-rake, throw-away tip. These boring units are housed in broached slots in the boring bar, each being clamped in position by a grub screw which engages the flat machined on the top of the body. The clamping arrangement for the throw-away tip is generally similar to that shown in Fig. 3, except that, in this instance, a chip-breaker is not fitted. This boring bar was developed for profile boring operations in a housing for a motor car power-steering unit.

As an example of the type of multi-purpose tool that can be built-up with the aid of throw-away tips, attention is drawn to Fig. 14, where a combination facing, boring and chamfering cutter is shown. This cutter, which was made by Modco, incorporates a total of nine rectangular tips (six long, and three short), for facing; an adjustable tool-holder, with a triangular-tip, for chamfering; and a Valenite micro-adjustable holder and tip, for boring. Designed for operations on a motor car transmission housing, this

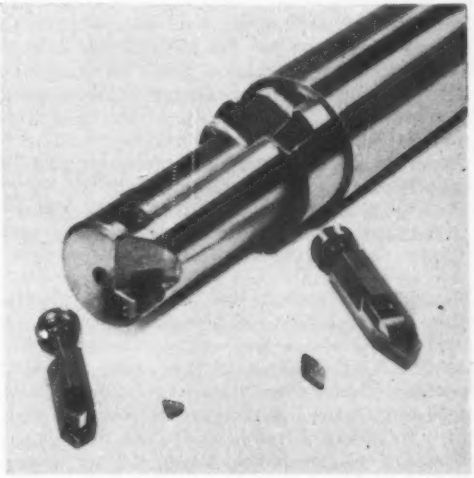


Fig. 13. This Boring-bar was Designed by Modco for Profile Boring Operations in a Motor Car Power-steering Housing. The Two Valenite Micro-adjustable Boring Tools are Housed in Broached Slots in the Bar

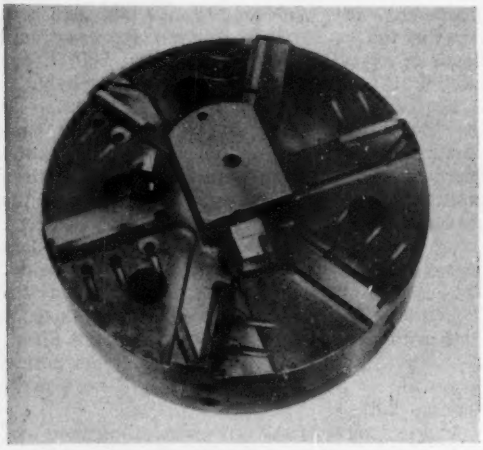


Fig. 14. An Example of the Type of Combination Cutter which can be Built-up with Throw-away Type Tips. A Total of Nine Rectangular Tips is Used for Facing; an Adjustable-holder with a Triangular Tip, for Chamfering; and a Valenite Micro-adjustable Holder and Tip, for Boring

cutter is used on a Heald Borematic machine. The trepanning cutters seen in Fig. 15 were also designed by Modco for operations on transmission housings, the tool at the right measuring 8¼ in. diameter, and that at the left, 5⅞ in. diameter. These tools are used on a Baker vertical, rotary indexing machine for trepanning aluminium alloy at a surface speed of 2,800 ft. per min. and a feed rate of 0·036 in. per rev. Other applications for which throw-away tips would appear to be suitable include reamers, drills, and broaches.

CONSIDERATIONS INVOLVED IN CHANGING-OVER TO THROW-AWAY TIP TOOLING

It is obvious that the primary consideration when contemplating a change-over to throw-away type tooling is whether such a change will be justified by the saving in time and money. It has been shown that the ease with which throw-away tips can be indexed permits, in itself, a considerable saving of down-time, in that tool-grinding operations are completely eliminated and re-positioning of the tool-holder is reduced to the minimum. In addition, with certain designs, where the tip seating is a loose piece, one tool-holder may be used for a variety of tip shapes, and this change-over can often be effected without removing the holder from the machine. Against these advantages, however, must be set the cost of the special tool-holders required, and the cost of the tips themselves (bearing in mind that, generally, they are not reclaimable).

It is evident, therefore, that those operations which have been found to require considerable time for setting-up, or tool replacement and re-grinding, or a combination of both, offer the best possibilities for a change-over to throw-away tooling. Before making a decision, the exact production costs with the existing tooling methods must be known, and the cost of the same operations when performed by throw-away tooling must be estimated.

Normally, throw-away tooling can be used successfully on high-production automatics, also for heavy-duty cuts involving considerable stock removal, and for finishing operations where a hard grade of carbide is usually employed. On the other hand, this type of tooling has its limitations, and may not prove so successful for close-tolerance facing, interrupted cuts, or for machining heavily-scaled workpieces, nor is it recommended for use on machines which are in poor condition. As has been mentioned, throw-away tips designed for negative rake cutting provide more cutting edges, because the insert may be inverted as well as indexed, and it has been found, in practice, that this type of cutting can be employed for the majority of operations. Possible exceptions are small-diameter turning; operations on long, slender

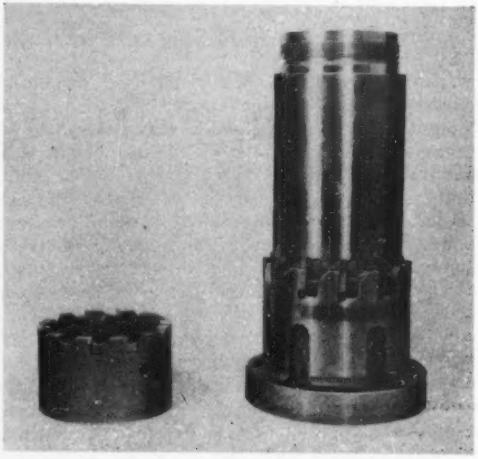


Fig. 15. These Modco-designed Trepanning Cutters Incorporate Square Throw-away Tips, and are Used for Trepanning Aluminium Transmission Housings at a Cutting Speed of 2,800 Surface ft. per min., and a Feed Rate of 0·036 in. per rev.

shafts; facing cuts on thin sections; boring; and the machining of some types of non-ferrous alloys.

Mention may be made at this point of the number of different types and sizes of throw-away tips which are commercially available in the U.S.A., and the means of identification that are employed. The three forms of tip most frequently used are square, triangular, and circular, and these range in thickness from ⅛ to ⅜ in., in steps of $\frac{1}{16}$ in. Square tips usually measure ⅜, ½, or ¾ in., triangular tips usually have inscribed circle diameters, of ¼, ⅜, ½, or ⅝ in.; and round tips have diameters of ⅜ or ½ in. Other shapes, such as diamond or pentagonal, have also been produced. The latter offer the advantage of an increased number of cutting edges, and the angular arrangement of the sides is such that for turning operations the tip provides an approach angle of 30 deg. and a trailing angle of 12 deg. Most suppliers provide two grades of tip, name, utility and precision, and the latter, which are used for close-tolerance and finishing operations, are accurately ground on all faces. The standard dimensional limits on the tips are ±0·001 in., but some manufacturers maintain a tolerance of 0·001 in. Utility grade inserts can be obtained for approximately one half the cost of the precision grade. Being intended for roughing work, they are ground on the top and bottom faces only.

A standard for throw-away inserts has been compiled by the A.S.T.E. National Carbide Standardization Committee, and it is hoped that this will be adopted as—or at least form the basis for—an American Standard. This standard includes recommendations for sizes, shapes, and designations of solid, sintered carbide tips, and their holders. The standard radii recommended for the corners of the tips vary from $\frac{1}{32}$ to $\frac{5}{32}$ in., according to the size of the tip, and it should be mentioned here that the selection of the correct corner radius for a particular machining operation is of considerable importance from the standpoint of the surface finish obtained on the workpiece.

Owing to the fact that there is so little physical difference between tips of the same or different grades made by various suppliers, a certain amount of trouble has been caused in the past by operators selecting the wrong grades of tips for particular jobs. To avoid such confusion, some suppliers are now impressing each tip with an identifying number or letter, and others are employing a colour code.

As has been stated already, when all the available cutting edges of a tip have been used, it should be discarded, and, generally speaking, it is not desirable to attempt a re-grinding operation. Where tips have been used on the corners only, however, the undamaged straight edges may be utilized for chamfering or plunge-cutting operations. In some other instances, where the tips have been worn on the corners only, users have found it profitable to return the tips to the suppliers, who are able to extend the life by grinding larger radii.

THE IMPORTANCE OF REGULAR AND PREDETERMINED INDEXING

While the dimensions of the workpieces being produced with a throw-away tip set-up remain within the specified tolerances, there is a natural tendency to refrain from indexing the tip. To specify, categorically, when a tip should be indexed is difficult, as so much depends upon the requirements of the particular machining operation. Some users insist that the tip should be indexed when a predetermined number of workpieces has been produced, others, that this action should be taken when the width of the wear land on the tip has exceeded a certain amount, say 0·030 in. According to the application, however, this "maximum allowable" wear land width may be as small as 0·015 in. or as great as 0·050 in. One aircraft manufacturer in the U.S.A. specifies that a tip should be indexed, to present a fresh cutting edge, when a certain number of cubic inches of metal has been removed, but this figure, again, is qualified according to the type of material being machined, the depth of cut, and the surface speed employed.

Summarizing the foregoing, therefore, it can be said that the indexing period for any particular tip is determined largely by the nature of the machining operation involved, and that in order to obtain the longest possible life from each cutting edge, and still retain the desired accuracy and surface finish on the workpiece, each case must be assessed on its own merits, and a certain amount of experimenting may be necessary. It is certain, however, that any tip should be indexed before the cutting edge which is in use has become dulled, as, economically, it is better to sacrifice a small amount of tool life rather than risk producing a number of components which are not acceptable on the grounds of inaccuracy or finish.

CONCLUSION

A certain amount of special training is recommended for machine operators in the manner in which throw-away tip tools should be handled and applied, and comprehensive cutting speed and feed rate charts should be made available to

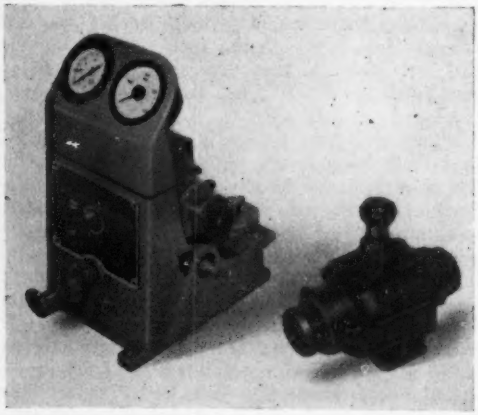
those concerned. In general, the same workshop practice can be followed for throw-away tip as for brazed tools, but with the former the need for scrupulous cleanliness, with regard to the component parts of the tool clamping assembly, cannot be stressed too strongly. It is essential that the tip should make overall, intimate contact with its seating, and the seating with the tool-holder. Similarly, the clamping piece, or chip-breaker, must contact the tip evenly, so that the force exerted by the locking screw is correctly applied. The presence of dirt between any of the parts may result in unequal stresses in the tip. In these circumstances, the tip may vibrate, with consequent chipping or cratering at the cutting edge, poor surface finish on the workpiece, or, in extreme cases, fracture. Continuous attention must be paid to the tool-holders, so that wear at the tip-seatings, clamps, and locking screws may be detected as soon as possible, and the parts replaced. In some cases, where the tip seating has become excessively worn, it has been found possible to salvage the holder by brazing, or the metal spraying process.

Unless a comprehensive inspection and maintenance system is applied to cover the points just mentioned, these tools cannot operate at the maximum efficiency.

Heenan & Froude I.E. Dynamometer

The I.E. dynamometer shown on the left in the figure has recently been introduced by Heenan & Froude, Ltd., Worcester, to provide an inexpensive means for measuring the power developed by internal combustion engines and various types of motors.

Made in three sizes with ratings from 20 h.p. at speeds of 4,600/6,000 r.p.m. to 100 h.p. at 2,500/4,000 r.p.m., the unit enables power output



(Left) Heenan & Froude I.E. Dynamometer, and (right) the Stator and Rotor Unit which can be Supplied Separately for Use as a Brake

to be measured to an accuracy within ±1 per cent when full torque is transmitted. If required, the stator and rotor assembly, and its housing, which has provision for foot mounting, can be supplied separately for use as a brake, and one of these units can be seen at the right in the illustration.

Of the single-sided type, the stator and rotor assembly is designed so that balanced end thrust is obtained. A knob-operated valve is fitted which provides for close control of the water supply to the impellor on the rotor shaft, whereby loads are applied.

When the unit is supplied as a dynamometer, the housing for the stator and rotor assembly is mounted on its side on a platform which can pivot about a horizontal axis in bearings in the base. The housing is connected to a fixed load-measuring head by an arm which is bolted to the mounting foot. Provision is made at both ends of the rotor shaft for the attachment of a tacho-generator, so that the dynamometer may be used for testing prime movers which run in either direction.

The dial-type speed indicator is connected to the tacho-generator by a cable, and the torque indicator, also of the dial type, is coupled to the load measuring head by a 20-ft. long small-bore hose. Both instruments are mounted on a bracket which can be removed from the base if required and set at a distance from the dynamometer, in order to provide remote indication of torque and speed.

An attachment is supplied which enables the dynamometer to be checked for accuracy. This attachment takes the form of an arm which can be secured to the pivoted platform and carries hangers at its ends, to take slotted circular weights. With this arrangement, accurate torque values can be applied to the dynamometer for checking the readings which are obtained on the torque indicator.

The unit is intended to supplement dynamometers from the company's range which incorporate stator and rotor assemblies of double-sided design, and permit the power output of engines to be measured to an accuracy within ¼ per cent.

Ferodo Sintered Metal and Cerametallic Friction Materials

Ferodo, Ltd., Chapel-en-le-Frith, Derbyshire, are now producing sintered metal facings on a large scale for new designs of clutches and brakes, also a comprehensive range of replacement facings. In this connection, they are operating in collaboration with the S.K. Wellman Co., U.S.A., and have had the benefit of their experience in the design of production plant for the purpose.

It is pointed out that these sintered metals will not replace asbestos-based products. They will, however, enable clutches to be designed for duties beyond the scope of conventional linings and facings. They will also provide replacement linings and facings for heavy equipment, mainly of American design, where they have been adopted as standard for certain brake and clutch applications.

Sintered metal linings are produced by the compression and partial fusion of very fine particles, mainly of metals, and under certain conditions of high unit loading they give longer life and more stable friction than asbestos-based materials.

The facings take the form of flat discs or segments (Fig. 1), generally with steel backing or core members, and may be very thin by traditional standards. Complete units may then be mounted by riveting. More frequently, however, the core member is gear-cut or splined to transmit torque, as seen in Fig. 2. Facings are supplied for operating dry or in oil-immersed conditions, and are said to give good service against normally accepted steel or alloy mating members.

Since dies and tools are essential for the manufacturing process, special sizes can only be offered at economical prices when suitable quantities are required. It should also be borne in mind that where such operations as spline hardening, grooving and slotting are specified, the cost of the part is necessarily increased.

Because metal powder material absorbs energy and conducts heat faster than most organic or mineral friction materials, it can be used under conditions which would lead to excessive temperatures with asbestos-based facings. The coefficient of friction of sintered metal is lower than that of asbestos-based materials, but is maintained through a much wider range of temperature and pressure variation. This characteristic is of particular value for protective and torque limiting clutches.

The metallic matrix is not affected appreciably by heat, cold or dampness, and quickly recovers from contamination by oil or solvents. In a dry unit, the clutch action clears away foreign substances or fluids, and thus restores the coefficient of friction of the facing.

Since the sintered metal friction materials can withstand high pressures, moreover, smaller, lighter, and more compact clutches can be employed for high energy absorption applications. For dry applications, the sintered metal is supplied with a special surface finish to ensure rapid and smooth bedding-in.

Typical applications of sintered facings include the steering clutches of crawler tractors, master clutches for all types of tractors, clutches for road rollers, and steering clutches for tracklaying fighting vehicles. It is claimed that they can also be employed with advantage for the multi-plate oil-immersed clutches employed in automatic gear boxes for all types of road and rail vehicles, also for the clutches which lock the torque converters used in rail-car propulsion.

Fig. 1. Ferodo Sintered Metal Segmental Facings Formed on Individual Steel Backing Pieces

With most designs of electro-magnetic clutches and brakes, the air gap of the magnet is changed as the friction surface wears. Even very small changes in the gap affect the clamping force considerably, and wear of the friction facings must therefore be kept to a minimum if frequent adjustment is to be avoided. With sintered metal facings, which may have only a very thin layer of very wear-resistant friction material, full use can be made of this material. At the same time, good life between adjustments can be obtained.

In manufacture, the dry metal powders are cold compacted at high pressures, and the compacts are assembled on their backings or cores which have already been prepared so as to assist bonding. The assembly is then sintered in a reducing atmosphere at a temperature which may range up to 1,000 deg. C. After they have been sintered, the assemblies are finished by grinding, edge trimming, drilling, branding and other necessary operations.

The range of sintered materials available includes both bronze- and iron-base types, suitable for dry and oil-immersed applications, and for general and special duties. Ferodo, Ltd., can supply sintered metal facings complete with cores or backing members, or they can sinter the facings on to parts provided by the customer. Cores or backing members can be produced from any steel which can be copper plated. For some duties, the use of a fairly high carbon type of spring steel is recommended, especially where the core member is splined or gear-cut to transmit the torque.

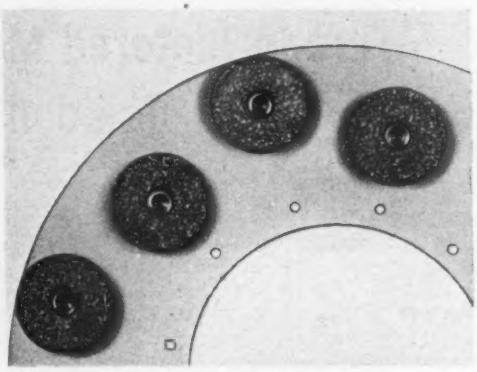


Fig. 3. Ferodo Cerametallic Friction Material is Employed in the Form of Circular Pads in Steel Cups, which are Riveted in Position

CERAMETALLIC FRICTION MATERIALS

Cerametallic friction materials are generally similar to the sintered metal products described, but contain a proportion of ceramic powder which increases heat and wear resistance, and raises the friction value. These advantages are offset, to some extent, by a tendency to abrasiveness and higher cost due to manipulating difficulties. The latter make it necessary to form the cerametallic friction material as a circular pad or button in a steel cup. A number of these buttons can then be riveted round the supporting member, as seen in Fig. 3. The principal applications for cerametallic materials are the clutches of earth-moving and agricultural machinery, and disc brake pads for aircraft.

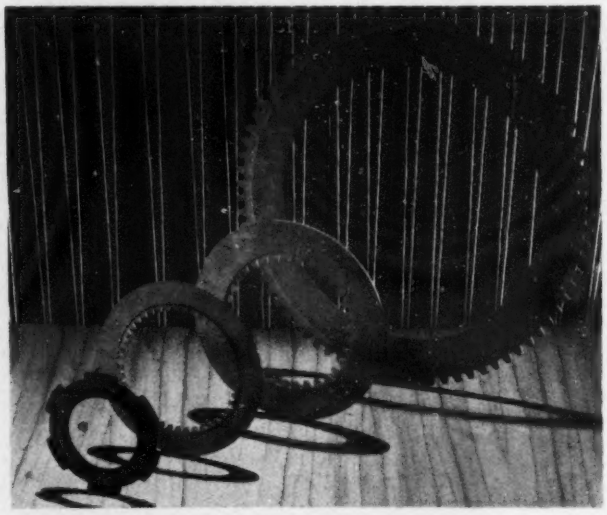


Fig. 2. Typical Clutch Discs with Ferodo Sintered Metal Facings. One is Faced With Iron-base and Three with Bronze-base Materials

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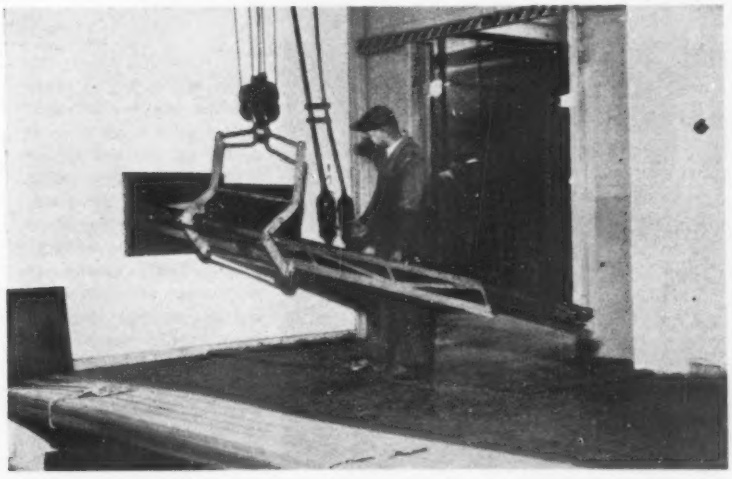
EXPORTS OF MACHINERY (other than electric) during the first three months of this year were valued at £145,937,384, as compared with £137,846,008, and £127,096,521, in the corresponding periods of 1957 and 1956, respectively. For the first quarter of 1958, the principal markets were Australia (£12·7 million), India (£11·7 million), and South Africa (£10·3 million).

Mechanical Handling Aids in a Modern Swedish Factory

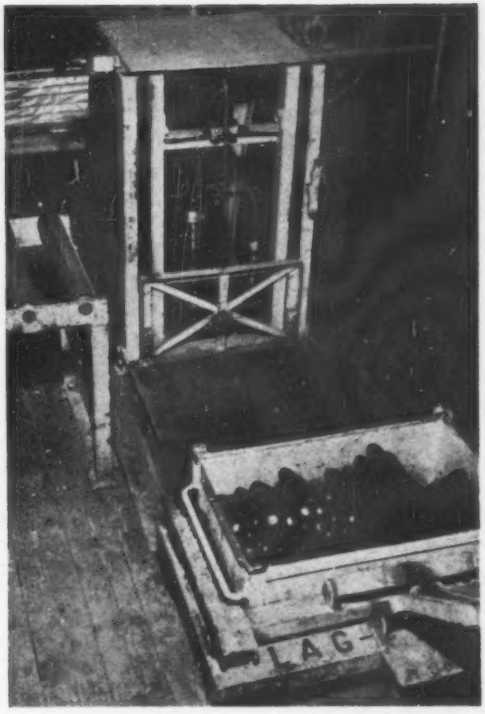
Reference has already been made in MACHINERY, 92/1011—2/5/58, to the extensive use of mechanical handling aids at the modern factory of E. A. Bergs Fabriks A-B, Eskilstuna, Sweden, where a wide range of hand-tools, including pliers, cutters, shears, knives, wood-chisels, and plane-irons, is produced. The majority of these aids were designed and built by the company, and they cover all phases of production, from the raw material to the finished product. Individually, many of them are simple, but collectively, they represent an important contribution to the high standard of productive efficiency maintained by the firm's 350 factory employees. Some typical examples are shown in the accompanying illustrations.

(right) These simple racks facilitate the transfer of bar stock from the raw materials stores to the forging shop, where they are placed on the floor next to the machines, and occupy little space. The power hoist in the stores, here seen in use, incorporates a weight-indicating device to facilitate estimation of batch quantities. The stock is in convenient, uniform lengths. A Yale & Towne fork-lift truck is used to carry loaded racks to the shop

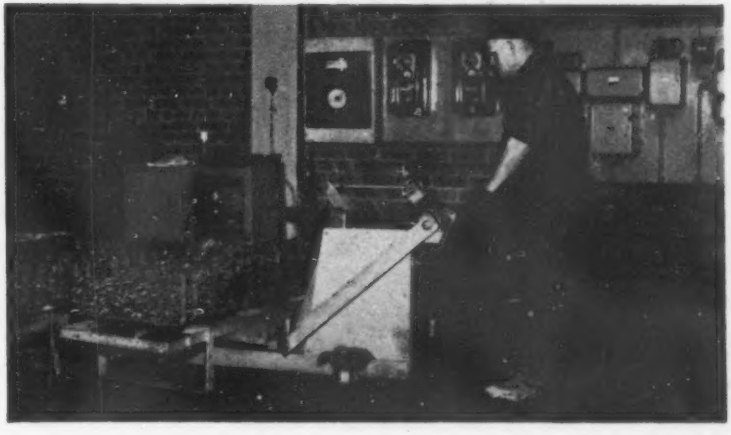


(left) A cradle is used to transfer flat stock, for knife-blanks, horizontally, from the stores to the press-shop. On the opposite side of the press-shop wall, the stock is drawn directly through the aperture seen, on to a large table. This table is at the same level as the bolsters of the presses, which it serves

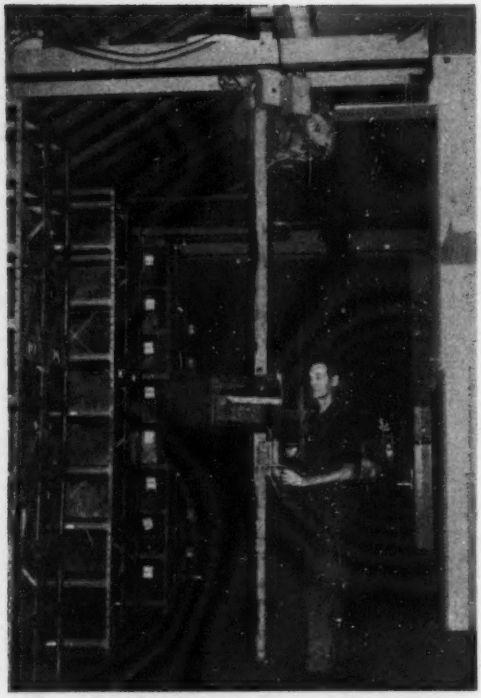
This fork-lift trolley incorporates a Keller air hoist, which rapidly raises and lowers the fork through a system of sprockets and chains, and serves a storage rack for boxes of finished components, near the head of the power-driven band-type packaging conveyor



This pneumatically-operated lift, at the head of the packaging line, is used to raise the boxes of components to the level of the conveyor. Boxes are moved from the lift platform on to a section of roller track at the head of the conveyor. Small lift trolleys are employed for delivering boxes to the lift

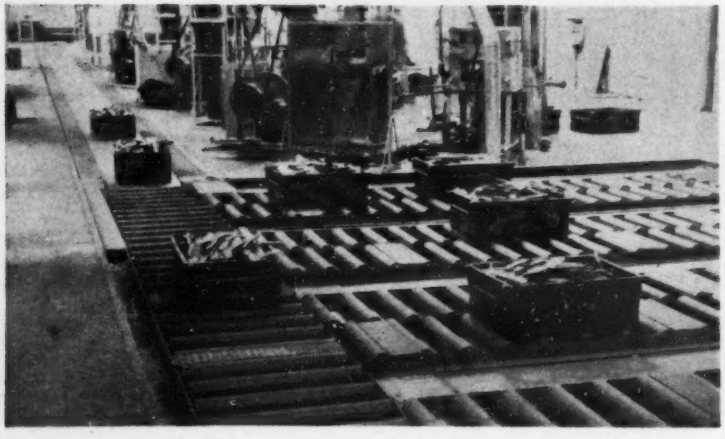


(right) This Newton Hydra-truck lifting trolley is employed for handling cradles of components, on pallets, at the 30-kW, electric annealing furnaces. Hydraulic power is supplied by a hand pump. The loaded pallets are raised on to stands in front of the furnaces, and the cradles are moved along skid-rails, incorporated in the pallets, on to turn-tables



This electrically-operated pendant-type fork-lift device, in the stampings stores, enables the boxes of stampings to be raised rapidly from floor level into the racks. Guided by means of pistol-grip handles, and controlled by push-buttons, it can be manoeuvred freely in narrow gangways. The fork is elevated by a screw

The fork of this lifting trolley is actuated by a pair of vertical pneumatic rams, and a self-coiling system of suspension is employed for the air line, so that movement is not unduly restricted. Trolleys of this type are used at various bench stations in the production lines, and raising and lowering are controlled by a valve lever



(left) In the forging shop, the stampings are placed in steel boxes, which are delivered to a marshalling and buffer-storage area on a band-type power conveyor in the centre of the main gangway, as seen in the background. The conveyor-band is a continuous steel strip, and is flush with the shop floor. The arrangement of the roller tracks enables the boxes to be conveniently disposed, and any particular box can be withdrawn for transfer to the stores or shops

the work. A dial-gauge, for thickness-measurement, is mounted on a pivoted portion of the upper limb, which is swung upwards, as shown, for loading. In the working position, the pivoted portion is held against a stop-pin *G*, by a small spring-loaded catch *H*. The caliper frame assembly is arranged to move freely, on three preloaded ball bearings, on a vertical column *J*, which supports a second dial-gauge. The stem of this instrument engages the top of the caliper frame *F*, the weight of which is counterbalanced by the two long tension-springs *K*. Thus, when the equipment is in use, the caliper frame aligns itself according to the position of the fixed gauging point, which is in contact with the under-side of the work, and a reading of the distance of this point from the datum plane of the boss is given by the second dial-gauge. Both dial-gauges are of the Mercer 1-in., long-range type, and read to 0·001 in.

In addition to providing for a rapid, accurate check of the dimensional characteristics mentioned, the equipment is useful for checking any "wobble" of the disc about the boss axis. For this purpose, the work and mandrel are rotated, and the dial-gauges observed. To facilitate initial longitudinal setting of the feed-shaft *D* and the gauging-head slide, without rotating the graduated drum *E*, the feed-shaft is provided with a collar and compression spring, and adjustment is effected by means of a pair of lock-nuts.

Fig. 4. Close-up View of the 2-ft. 6-in. Diameter Air-flotation Support-plate, Showing the Arrangement of the Locating Ball Bearings and Dust Guards

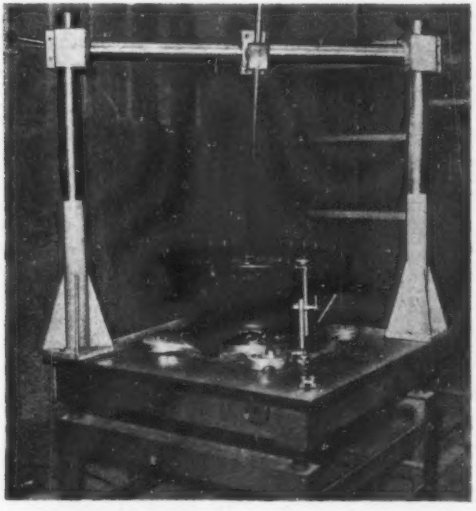


Fig. 3. This Air-flotation Fixture was Developed to Facilitate the Checking of Large Engine Components

AIR-FLOTATION CHECKING FIXTURE

Reference has already been made in earlier articles in MACHINERY to various applications of the "air flotation" principle, whereby heavy jigs and fixtures are supported on a thin layer of compressed air, so that they can readily be moved by hand. At the Napier works, it is frequently necessary to check large engine casings such as the magnesium-alloy component seen in Fig. 3 and 4, and, in this connection, the air flotation principle has been applied with advantage in the specially-developed equipment shown. This equipment comprises a 4-ft. square grade A Windley surface-table, in the centre of which is mounted a 2-ft. 6-in. diameter circular air-flotation plate.

Located by ball bearings, which engage the edge, the plate is grooved on the underside, and has T-slots for clamping the work. The ball bearings are adjustably mounted on eccentric pins, and four are used in preference to three in order to minimize the effects of any play due to

Special-purpose Measuring Equipment

Reference has already been made in MACHINERY, 92/1095—9/5/58, to some examples of special-purpose measuring equipment developed by D. Napier & Son, Ltd., Acton, London, W.3, in connection with their work on gas turbines. Here, two further items are discussed. Certain types of turbine and compressor discs, such as that seen set-up for checking in Fig. 1, are dimensioned in the following manner. The thicknesses of the web are given at certain radial distances from the centre, and are related, by a corresponding series of ordinates, to a datum-plane defined by one face of the boss. Close tolerances are stipulated, and accurate checking with standard-type measuring equipment would be difficult and tedious. The special-purpose equipment shown in Fig. 1 and 2 has therefore been developed.

The component to be checked is placed on the rotatable mandrel A, Fig. 2, which is rigidly mounted on the channel-section base. This base, it may be noted, comprises a length of standard structural rolled-steel section. A flange on the mandrel supports the work by the datum-face of the boss, and the splined bore is located by the major diameter. For this purpose, three radially-disposed, spherical-ended pins, *B*, are moved outwards by an internal conical member, actuated by the finger-nut *C*. The edges of the flanges on the channel-section base are machined to provide ways for the gauging-head slide, which is adjustable longitudinally by means of a 1-in. pitch, helically-grooved feed-shaft *D*. This shaft is provided with a graduated drum *E*, Fig. 1, which, in conjunction with a vernier scale, permits of setting the radial distance of the gauging-contacts from the centre of the mandrel, to within 0·001 in.

The gauging head comprises a caliper-frame *F*, Fig. 2, and a fixed gauging point on the lower limb makes contact with the under-side of

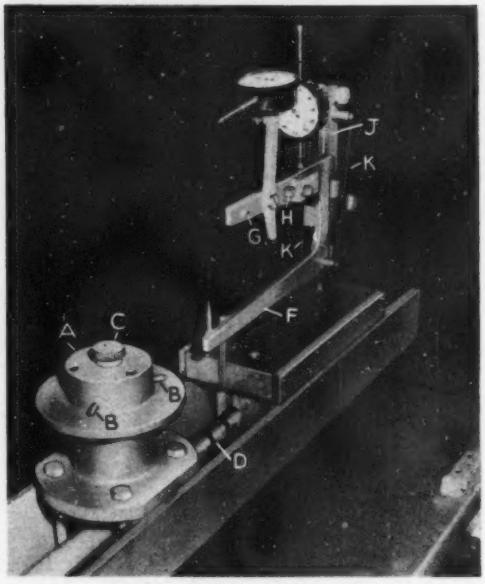


Fig. 2. A View of the Compressor-disc Checking Equipment Unloaded, Showing the Gauging-head Slide, Caliper Frame, Feed-shaft, and Rotatable Work-locating Mandrel

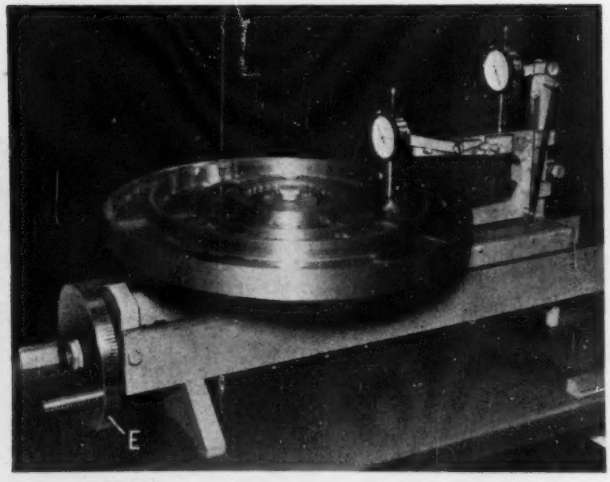


Fig. 1. Dial-gauge Equipment for Measuring Turbine- and Compressor-disc Thickness, and Relationship to a Datum Plane, at Predetermined Radial Distances

maladjustment. As may be observed in Fig. 4, the ball bearings are enclosed in guards to prevent the ingress of dirt, and to the same end, a felt ring surrounds the plate, where it abuts the face of the surface-table. Rigid columns, of 3-in. diameter steel tube, are attached to diagonally-opposite corners of the table, and serve to support a horizontal member of similar material, which is vertically adjustable. Tubular dial-gauge supports, of ¾ in. diameter, are adjustably attached to the cross-member. Dial-gauges set up in this manner are employed principally for internal work, and the unoccupied corners of the surface-table are utilized for conventional dial-gauge stands.

When a pedal is depressed, air, controlled at a pressure of 5 lb. per sq. in. by a regulator-valve, is admitted through a hole in the table, to the centre of the plate. This pressure, it may be noted, is not critical. If the weight of the work is reasonably in balance, it can be gauged rotationally while "floating," without risk of introducing errors.

In this condition, the plate can readily be turned with one finger. If, however, it is heavily unbalanced, the air-pressure is shut off, and static readings are taken. The air consumption is low, and investigations undertaken by the company have shown that only 2 cu. in. of free air per min. are required to "float" a load of 1 cwt. per 100 sq. in. of support-surface. These figures, it is pointed out, were obtained for a square test-plate. For ease of reading from various positions, double-faced Verdict dial-gauges are employed, which were supplied specially for this purpose.

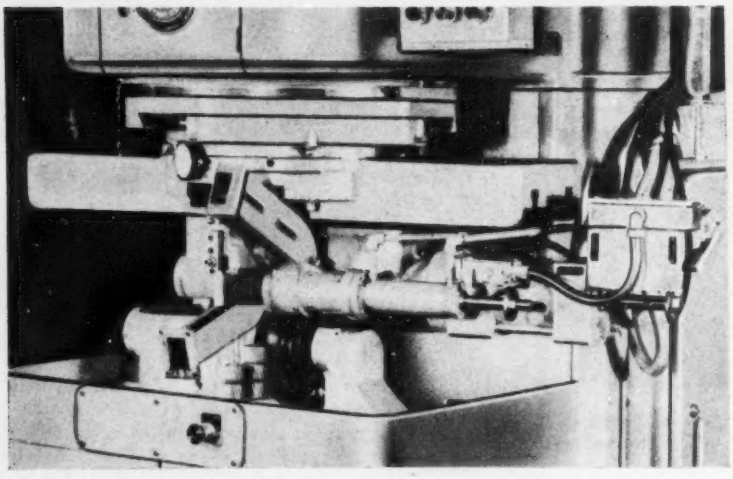
New Work-handling Equipment for Michigan Gear Shavers

The Michigan Tool Co., Detroit, Michigan, U.S.A., have introduced a new work loading and unloading unit for use on their series 870 gear shaving machines. A close-up view of the unit, mounted on a type 870-A gear shaver, is shown in the figure. This equipment will handle gears up to about 4 in. diameter, and is intended for connection to a "demand" type work distribution system. Loading, shaving, and unloading of gears is carried out on a fully automatic cycle, and several machines can be tended by one man.

Gears to be shaved roll down an inclined chute, and are transferred, one at a time, on to a loading slide, by an air-operated plunger. If required, a gauging system can be incorporated in the chute, to ensure that over-size parts do not pass to the loading slide. Also air-operated, the loading slide carries the gear to the shaving position, where it is brought into mesh with the cutter, and held by a pair of air-operated centres. In the event of incorrect engagement between the gear and cutter, the centres are prevented from closing by a sensing device. The slide then returns to its original position, and the loading cycle is repeated.

Upon completion of the automatic shaving cycle, the centres are opened, and the slide withdraws with the finished gear. When the next gear is transferred to the slide by the plunger, the finished gear is discharged into a second inclined chute. A signal lamp can be provided which shows when a pre-set number of gears has been shaved, to indicate that the cutter requires to be sharpened.

Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, represent the Michigan Tool Co. in this country.



The New Work-handling Unit Mounted on a Michigan Type 870-A Gear Shaver

New Production Equipment

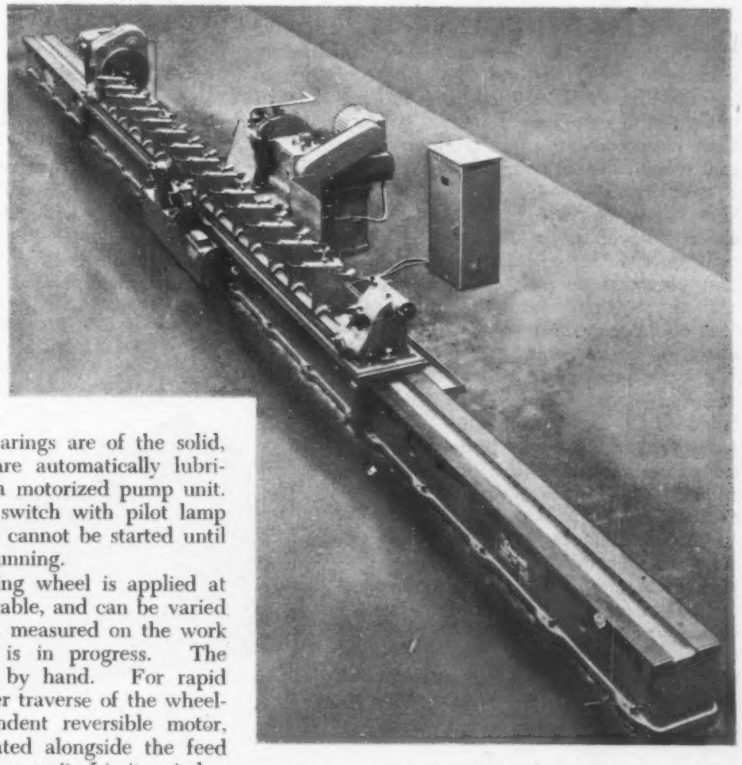
Churchill 36-in. by 30-ft. Heavy Plain Cylindrical Grinding Machine

The Churchill Machine Tool Co., Ltd., Broadheath, near Manchester, have recently built the 36-in. swing by 30-ft. length capacity, type FB, heavy plain cylindrical grinding machine, here illustrated, for William Asquith, Ltd., Halifax, for operations on long machine tool shafts and feed screws. With the standard grinding wheel of 30 in. diameter by 3 in. wide, work up to 32 in. diameter can be ground. For grinding 36 in. diameter, a 26-in. diameter abrasive wheel is employed.

Designed to provide rigid support for the bearings with a minimum centre height of the grinding wheel, the wheel-head is equipped with a large-diameter nitralloy steel, spindle, to which the drive is transmitted by multi-V ropes from a 20-h.p. motor, speeds of 650 and 750 r.p.m. being provided. The spindle bearings are of the solid, cone-adjusted type, and are automatically lubricated with filtered oil by a motorized pump unit. An electrical interlocking switch with pilot lamp is provided so that spindle cannot be started until the lubricating pump is running.

Cross-feed to the grinding wheel is applied at each reversal of the work table, and can be varied from 0·00025 to 0·002 in., measured on the work diameter, while grinding is in progress. The feed can also be applied by hand. For rapid forward or backward power traverse of the wheel-head, there is an independent reversible motor, controlled by a lever located alongside the feed handwheel on the front apron unit. Limit switches are incorporated to prevent over-running, and when the power traverse is in operation, the normal feed is automatically disengaged.

The dead-centre type work-head is positively located on the table by inverted V- and flat-ways. Drive is taken from a 7½/10 h.p. motor, through cone pulleys, a change speed gearbox and chain, and eight speeds from 12½ to 75 r.p.m. can be obtained. All shafts run in ball bearings and oil bath lubrication is provided. The work-head can be positioned longitudinally by rack and pinion.



Churchill 36-in. by 30-ft. Heavy Plain Cylindrical Grinding Machine

A non-swivelling type table, which does not overhang the bed at the extremities of traverse, is mounted on broad slideways, and lubrication is by filtered oil under pressure from an independent, interlocked, motor-driven oil pump. Table traverse is provided by a 3-speed, 3-h.p. motor, which drives through multiple V-belts to a 5-speed gate-change gearbox incorporated in the front control apron, and the 15 rates of traverse range from 3 to 65 in. per min. Final drive to the table is transmitted through a rack and pinion, and provision is made for variable mechanical dwell. Length of traverse is set by dogs, which have fine adjustment so that the point of reversal can be accurately determined. Hand table traverse is also available.

The tailstock has a spring-loaded spindle to allow for any axial expansion of the work during grinding, and adjustment of the centre is made by handwheel. Of two-piece construction, the tailstock has set-over adjustment for alignment correction, and is readily positioned on the table by rack and pinion motion.

Wet grinding equipment supplied with the machine includes a Churchill swarf separator of circular construction, into which the coolant from the machine is discharged, and the metal swarf and grinding debris are deposited on the perimeter. Only clean coolant is passed for re-circulation into the main tank in which a motor-driven pump is submerged.

A mirror is provided so that a clear view of the contact of the grinding wheel with the work can be obtained, and as all the main mechanical and electrical controls are grouped in a small area on the front apron unit, the movements of the operator during the grinding operation are reduced to a minimum.

All the motors are of the totally-enclosed type and dynamically balanced. The heavy-duty contactor-type control gear is housed in a separate sheet-steel, floor mounting, cubicle, from which the motor connections are taken to a junction box on the machine bed. This equipment provides under-voltage and overload protection for the motors, and includes a main interlocked isolating switch to control the single electrical supply to the machine. The push-button controls housed on the front apron are of oil- and suds-proof type, and are shrouded to prevent accidental operation.

A centre grinding attachment is available, which is arranged for mounting on a platform above the spindle housing, and is driven by an independent motor with plug and socket connection. The housing can be swivelled to obtain the required angle for the centre.

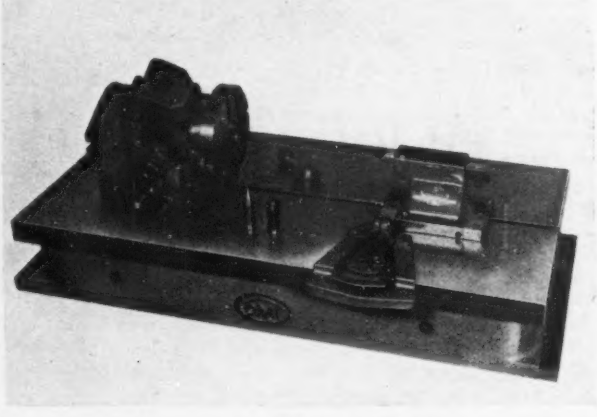
There are 14 work steadies, each with a capacity of 3 to 14 in. diameter. The floor space occupied by the machine is 68 by 11 ft., and the approximate weight is 35½ tons.

O.M.T. Type O.W.12 Optical Dividing Head

Optical Measuring Tools, Ltd., 142 Bridge Road, Maidenhead, Berks., have recently introduced the 3¼-in. centre optical dividing head shown in the figure.

Known as the type O.W.12, it is fitted with a micrometer-type eyepiece, which, in conjunction with the illuminated scale, gives readings to 2 sec. of arc. A dividing head of similar design, designated type O.W.7, is available, which has a fixed-type eyepiece and enables readings to 1 min. of arc to be obtained.

Locating surfaces machined accurately at right angles are provided on the base, so that the head can be mounted with the spindle vertical or horizontal. The worm gearing gives a reduction ratio of 60 to 1, and the worm can readily be disengaged, by movement of a lever, to enable the spindle to be rotated freely by hand, for making coarse settings with reference to graduations on a ring at the nose end. A knob-operated clamp, of similar design to those employed on O.M.T. rotary tables, is incorporated, which enables the spindle to be gripped without the risk of deflection.



O.M.T. Type O.W.12 Optical Dividing Head

Workpieces may be mounted on a faceplate, or held between centres or in collets, and a tailstock, with means for vertical adjustment of the centre, is available. The dividing head occupies a space of 7½ by 7½ in., and has an overall height of 6¾ in.

A 30-in. long by 15-in. wide by 6-in. high surface plate can be provided to carry the dividing head and tailstock, as shown, also for supporting a dial indicator stand, for instance, when inspection of workpieces is to be carried out. Workpieces up to 14½ in. long can then be held between centres. A dial indicator attachment, also shown in the figure, is available for accurately setting the headstock for alignment. In use, the cast iron frame of the attachment is moved by hand, in engagement with a scraped datum edge on the surface plate, and the measuring plunger of the dial indicator makes contact with datum surfaces on the dividing head and tailstock. The indicator gives readings to 0·0001 in.

Newall Group Sales, Ltd., Old Fletton, Peterborough, are the distributors for equipment made by Optical Measuring Tools, Ltd.

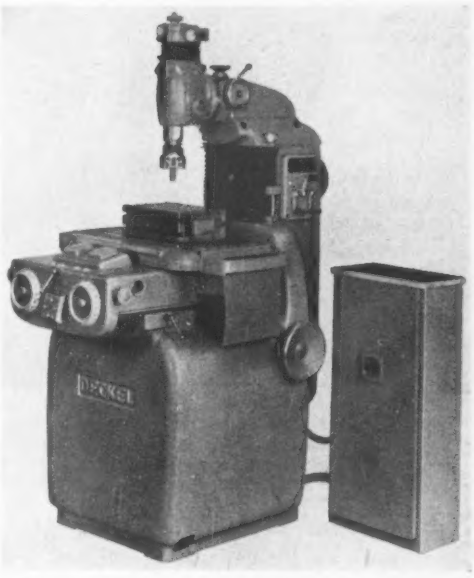


Fig. 1. Deckel Type LKB Optical Jig Borer

Deckel Jig Boring, Jig Grinding and Co-ordinate Measuring Machines

The German firm of Friedrich Deckel, for whom the sole agents in this country are Burton Griffiths & Co., Ltd., Mackadown Lane, Kitts Green, Birmingham, 33, have introduced the type LKB optical jig borer shown in Fig. 1, which can also be supplied as the type LKS machine, fitted with a jig grinding head, or as the type LKM, equipped with an optical projection unit for measuring purposes, as shown in Fig. 2. A feature of the design is that the three heads are interchangeable, so that the basic machine can readily be converted for whichever purpose it is required.

The work table measures 25¾ by 11⅛ in., and a co-ordinate setting capacity of 15¾ by 10 in. is provided through the medium of precision scales and direct-reading illuminated screens. Settings can be made to an accuracy of 0·00012 in., and, in addition to the fine hand adjustment, rapid power traverse is provided by push-button controlled motors.

A substantial column, moving in vertical ways at the rear of the bed, carries the spindle driving motor and gearbox, and horizontal V-ways are provided at the top, on which the boring, grinding or measuring head is located and clamped. The vertical adjustment of 13¾ in. can be effected by hand, or by push-button controlled motor, and the maximum height of work normally admitted for jig boring is 19·9 in. By the use of a raising block, a height capacity of 24 in. can be obtained. For jig grinding, the normal and extended height capacities are 14⅝ and 18½ in. An important feature in connection with the mounting for the spindle head is that the upper part of the column is so designed as to provide compensation for the effects of thermal expansion, so that consistent accuracy for the co-ordinate settings is ensured. For the same reason, all the electrical control equipment is housed within a separate floor-mounted cubicle.

On the jig borer, the spindle is driven by a motor of ¾ h.p., and 20 speeds, from 40 to 3,150 r.p.m., are available. There are six rates of power feed up and down, from 0·0004 to 0·005 in. per spindle rev., and the quill has a travel of 3⅛ in. Holes up to 15 mm. diameter (0·59 in.) can be drilled in steel. A precision depth stop is provided for the spindle quill, and in addition to power feed, there is a fine adjustment by hand. An important feature is that the spindle head can be swivelled through 90 deg. to the right and left, about a horizontal axis.

The jig grinder is fitted with an electrically-driven wheel spindle, and steplessly-variable speeds from 15,000 to 60,000 r.p.m. are provided by a frequency changer. There are 12 speeds

Fig. 2. Deckel Type LKM Optical Co-ordinate Measuring Machine which has the Same Base and Column Units as the Machine in Fig. 1

from 40 to 500 r.p.m. for the planetary housing which carries the grinding spindle, and three down feed rates, of 0·12, 0·24 and 0·48 in. per rev., are available. Bores from $\frac{1}{32}$ to 5 in. diameter can be ground, either parallel, or with an included taper angle up to 3 deg., and the vertical travel of the grinding spindle is 3¾ in. In addition, provision is made for swivelling the entire grinding head up to 45 deg. on each side of the centre-line, which extends the scope of the machine. Equipment available includes a form grinding attachment, wheel dressing attachments, an acoustic unit with amplifier and speaker to indicate contact of a diamond wheel with the work, and a dust extractor unit.

The optical measuring machine, Fig. 2, provides magnifications of 10× and 20× when the 8-in. diameter projection screen is being used, and 20× with the microscope. At 10× magnification, the diameter of the field on the work is 0·79 in. A vertical adjustment of 3¾ in. is provided for the projector, which can also be tilted 15 deg. to the right or left, as required, for example, when measuring screw threads. For projection by transmitted light, there is a ground glass auxiliary table, and a tilting work fixture, provided with centres, is available for cylindrical and tapered workpieces.

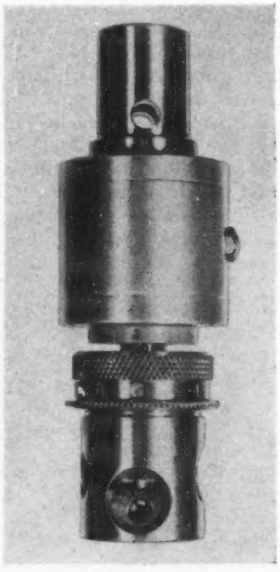
Other equipment, which is applicable to all three machines, includes a 12-in. diameter optical rotary table with an indexing accuracy of 5 sec. of arc, which can be used in either a horizontal or vertical position, and a Centricator centring and concentricity checking device.

Mini-Head Tapping Attachment

The Mini-Head tapping attachment shown in the figure is made by Simpro, Ltd., Minehead, Somerset, and the sole United Kingdom and overseas concessionnaires are W. O. Bullock & Sons, Ltd., 126 Rodbourne Road, Swindon, Wilts. Intended particularly for tapping plastics and non-ferrous metals, it has a capacity from 10 B.A. to 4 B.A., and can be employed on both vertical and horizontal spindles. Operating speeds may range from 600 to 850 r.p.m., depending on the size of the tap and the type of material, and the forward and reverse speed ratio is 1 : 1.

Weighing only 12 oz., the attachment is of 1⅝ in. diameter by 3$\frac{13}{16}$ in. long. The main boss is bored Jacobs Series 1 taper to receive the shank, and has a $\frac{7}{32}$ in. diameter cross hole so that a taper ejector can be applied from either side. Aluminium bronze tubing is employed for the body, and the end caps, which are also of this material, have Tufnol and steel inserted bearings. Drive is transmitted through Tufnol and phosphor bronze bevel gearing and inclined plane steel dogs, which provide for forward and reverse rotation, and all moving parts are packed with grease. A friction clutch, comprising hardened steel thrust washers, domed compression washers, and a Tufnol disc, is interposed between the main drive and the chuck. Adjustment is effected by means of a steel screw cap, graduated with numbers corresponding to B..A sizes.

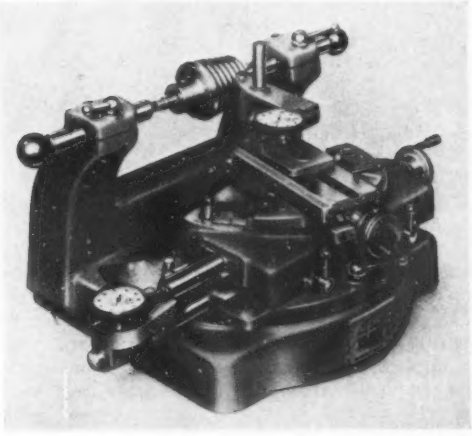
The top surface of the chuck forms the friction drive face, and the body is bored to receive two hardened steel jaws, with hollow head set screws for clamping the tap. The arrangement is self centring, and taps with cylindrical shanks up to 0·152 in. diameter can be held.



The Mini-Head Tapping Attachment

Stuart Davis FAC-1 Flank Angle Checking Machine

The accompanying illustration shows the type FAC-1 flank angle checking machine which has been developed by Stuart Davis, Ltd., Much Park Street, Coventry, for checking parallel or tapered



Stuart Davis FAC-1 Flank Angle Checking Machine

hobs and worms to a high degree of accuracy. This machine is designed to check, by direct measurement, helicoids and involute helicoids with flanks which are straight in the normal, or axial, plane.

The part to be inspected is held between centres, and the tooth flank is probed by a stylus which, through a 5:1 amplification mechanism, actuates a dial indicator graduated in 0·0001-in. divisions. A dovetail carriage is provided for moving the stylus and indicator towards, and away from, the work centre, and this carriage is, in turn, mounted on a swivel slide which can be set to the required flank angle by means of slip gauges and a built-in datum peg. This entire unit is mounted on a second swivel slide, which can be set parallel to the work axis, or at an angle thereto for tapered workpieces. Longitudinal adjustment for the carriage which is mounted on this swivel slide is obtained by the handwheel at the extreme right, and the dial indicator and measuring standard seen at the left are employed for advancing this slide, pitch by pitch, along the length of the workpiece. Clamps are provided for locking the various movements while the workpiece is being inspected.

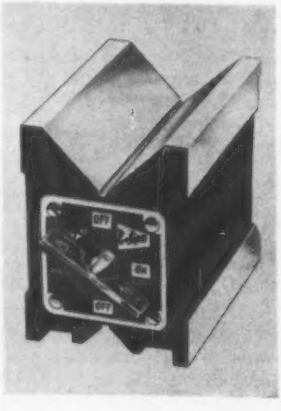
For checking involute helicoids, the stylus is set above the axis of the workpiece by an amount equal to the radius of the base circle, and it will be noted that the stylus and indicator housing is mounted on a ground vertical rod to permit of this adjustment. Then, the swivelling table is set to the required base lead angle of the work, and the bias of the stylus is adjusted according to the hand of the helix which is being inspected.

In addition to the applications already mentioned, this machine can be employed for measuring pitches of either parallel or tapered thread forms, and for measuring diameters by the pin method. The machine will admit maximum and minimum lengths, between centres, of 9 in. and 3 in., respectively, and a maximum diameter of 4 in. Workpieces with included angles up to a maximum of 60 deg. can be handled, and helical forms having flank angles up to 45 deg. in relation to the outside surface can be accommodated.

Eclipse Magnetic V-block

The magnetic V-block here shown is a recent addition to the range of Eclipse machine shop equipment made by James Neill & Co. (Sheffield), Ltd., Napier Street, Sheffield, 11.

V-shaped slots of different sizes are provided in opposite faces of the block for accommodating workpieces up to ⅞ and 2⅝ in. diameter. If required, the faces of the larger slot may be machined to give slightly increased capacity. Operation of a built-in rotary switch causes the faces of both slots, also accurately ground locating surfaces at the top, bottom, sides, and one end of the block, to be magnetized. In consequence, the work is gripped, and, simultaneously, the block may be secured to the table of a machine, for instance, without the need for clamps. Since a locating surface is provided at one end, the block can be mounted in the vertical as well as the horizontal posi-



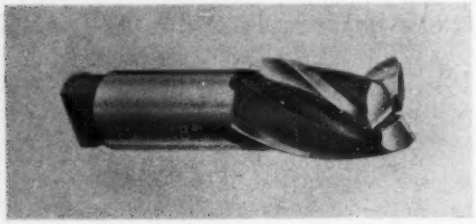
Eclipse Magnetic V-block

tion. Because this face can be magnetized, a stop plate may readily be secured to it for locating the work endwise when the V-block is set horizontally. The Eclipse Alcomax flux-control system is employed, to provide high clamping power.

Eclipse magnetic V-blocks can be supplied as single units or matched pairs, packed in polished wood cases.

Clare Routing Cutters

A range of newly-designed routing cutters has been introduced by Clare Collets, Ltd., Wright Street, Broadheath, Altrincham, Cheshire, one of which is shown in the accompanying illustration. The spiral angle and rake of these cutters have been designed to ensure the maximum metal removal rate, in addition to efficient chip clearance. As an example of the performance obtainable, it is stated that when machining a batch of



One of the Newly-designed Range of Clare Routing Cutters

steel castings a 2½-in. diameter cutter was used to mill a slot 2½ in. wide by 1½ in. deep, at a feed rate of 2 in. per min. The metal-removal rate obtained during this operation was 7½ cu. in. per min.

The range extends from ⅞ to 2½ in. diameter for 3-fluted cutters, and from 2¾ to 3 in. diameter for 5-fluted cutters. Cutters larger that 3 in. diameter can be made to customers' special requirements.

Magcodrill Unit with Magnetic Stand

In the accompanying illustration is shown an example from the range of Magcodrill units which has been introduced by The Magnetic Equipment Co., Ltd., Lake Works, Portchester, Hants. The unit comprises a Black & Decker drill, which may have a maximum drilling capacity from ⅜ to 1¼ in., and a special magnetic stand. Light alloy side members support a ground steel guide on which

Magcodrill Unit with Magnetic Stand

the drill is traversed by hand lever, through pinion and rack, the maximum stroke ranging up to 10 in., according to the size of the unit.

Magcodrills of ⅜ in. capacity and above have an adjustable magnet control unit so that the grip can be varied. With this arrangement, the unit can readily be moved to centre the drill with a mark. Positioning is facilitated by a built-in flood light, except for the smallest size, and when the setting has been obtained, the full magnetic power is applied, and holding forces up to 2,000 lb. can be obtained. If required, these units can be employed in the inverted, horizontal, or angular positions.

Rudor Plunger-type Toggle Clamp

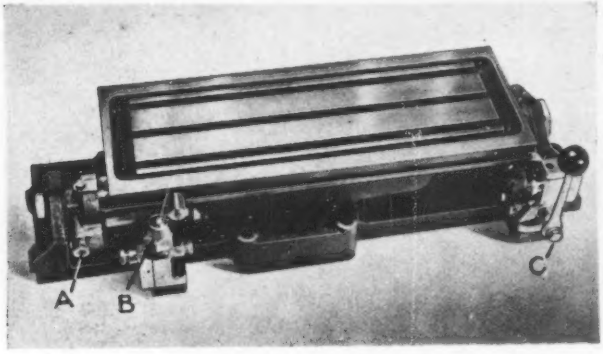
The Rudor plunger-type toggle clamp, here shown, has recently been placed on the market by Harold G. Ruddick & Co., Ltd., Alpha Works, Havelock Road, Southall, Middlesex.

This clamp, which is the subject of a patent application, has an overall length of only 3½ in., and enables variable loads up to 300 lb. to be applied to the work. It can be mounted in a variety of positions for holding workpieces while welding, brazing, soldering, drilling and sawing operations, for instance, are being carried out, and the end of the plunger is internally threaded to permit clamping pieces of different shapes to be fitted. An adjustable plunger travel up to 1 in., with spring return, is provided.

Rudor Plunger-type Toggle Clamp

Weston Air-hydraulic Work Table

The air-hydraulic work table shown in the accompanying figure is now being produced by The Weston Machine Tool Co., Ltd., 210 Bracebridge Street, Birmingham, 6. Measuring 24 by 8 by 5 in. high, the unit incorporates an air cylinder and a hydraulic check cylinder, both of which are housed between the work table and the base casting, and it is delivered for operation from a normal air supply at 70 to 100 lb. per sq. in. The work table, which measures 18 by 6½ in., has a 5-in. travel, and provision is made for rapid approach and return movements.



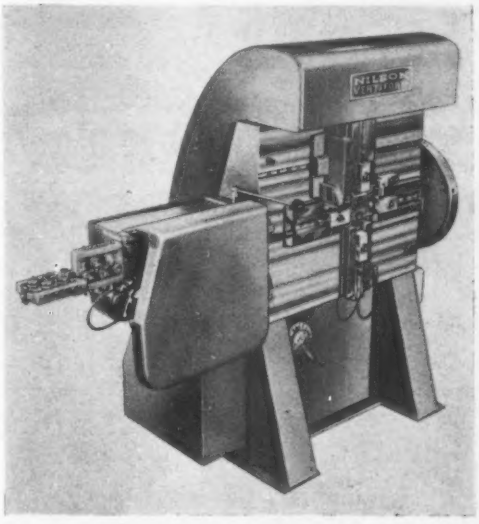
Weston Air-hydraulic Work Table

Steplessly-variable feed rates from 4 to 20 in. per min. can be obtained by adjusting the control valve *A*, fitted to the hydraulic cylinder. The trip valve at *B* initiates the fast return movement of the table. A hand-operated air control at *C* provides for starting, stopping or reversing the table motion at any point. The table moves in dovetail slideways which are arranged for gravity lubrication and provided with adjustable gibs. Weighing 70 lb., the unit is intended for use on hand-feed milling machines, also on grinding machines and special-purpose equipment. Fixing holes are provided in the main casting, and there are tenon slots in the base to facilitate setting.

Nilson Vertiform 4-slide Machine

The Vertiform 4-slide wire and strip forming machine shown in the figure has been introduced by The A. H. Nilson Machine Co., Shelton, Connecticut, U.S.A. It will be observed that the slides operate in the vertical plane, and various advantages are claimed for this arrangement. The finished work is ejected to the front of the machine, and, if required, it can conveniently be delivered on to rails for automatic transfer to other stations for subsequent processing. Tooling is readily accessible, and an unobstructed view of the work is afforded. Moreover, the machine occupies comparatively little floor space, and can be arranged for hopper or magazine feeding.

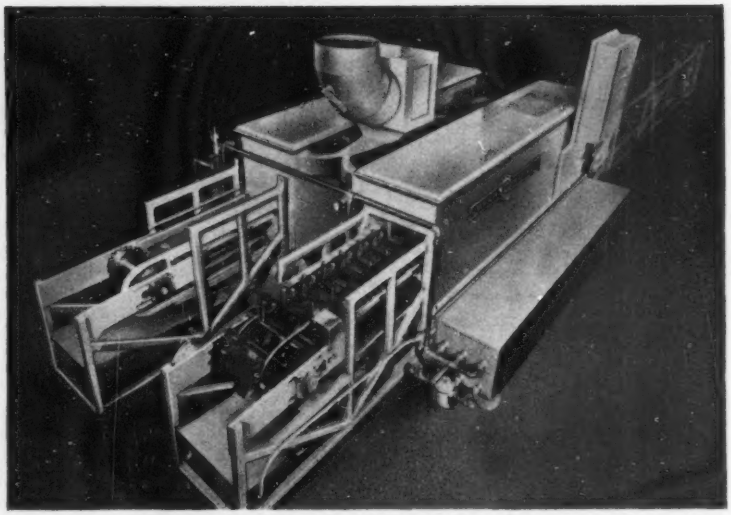
Wire up to 0·187 in. diameter, and strip up to 1¼ in. wide, can be formed, and the normal maximum length of feed is 15 in. By changing two gears in the feed unit, however, this length may be doubled. A roll-type stock straightener forms part of the standard equipment, and the feed mechanism is a self-contained unit which can be omitted from the machine if blanks are to be supplied from a magazine or hopper. With the normal cycle, stock is straightened, fed, gripped, cut-off, formed, and ejected. The forming bracket is rigidly mounted on the bed, and the four forming slides are operated through rollers which are centrally mounted on needle rollers. These rollers engage tracks in drum cams of hardened steel, which are rigidly mounted in the bed and independently driven through gearing. Each slide



Nilson Vertiform 4-slide Machine for Forming Wire and Strip

has a stroke of 2½ in.

Drive is taken from a 2-h.p. motor through a variable-speed unit to a plate-type friction clutch, and the operating speeds normally range from 30 to 120 strokes per min. There is a built-in automatic lubricating system for all moving parts. A choice of four stripper strokes, from $\frac{5}{16}$ to $1\frac{7}{16}$ in. is provided. Standard equipment includes a built-in "form-moving" attachment for which, again, there are four stroke lengths, from $\frac{7}{16}$ to $1\frac{5}{16}$ in. This latter attachment provides for moving the work after it has been partially formed for completion at a second stage.



Gear-O-Mation Hot-washing and Drying Machine

Press attachments of 4 tons capacity can be supplied to order, for mounting on the vertical face of the frame, and are designed for use with standard interchangeable die sets. With this arrangement, pierced slugs and scrap fall clear by gravity. Provision can be made, if required, for threading, hollow milling, or chamfering operations to be performed during the cycle.

Fluorescent lighting is provided over the tooling area, and as a safety measure it is ensured that the machine can be power operated only when a handbar is withdrawn from the handwheel and inserted in a switch socket.

Gear-O-Mation Hot-washing and Drying Machine

A machine for the automatic hot-washing and air-drying of batch-produced parts has been developed by the Gear-O-Mation division of the Michigan Tool Co., U.S.A., and equipment which was built by this company for handling a particular motor car transmission shaft is here shown. In this instance, two complete washing and drying units were provided, that at the left having been supplied in anticipation of a future increase in production rates. These two units are identical, and, as can be seen on the machine at the right, a chain-driven conveyor is fitted. This conveyor incorporates cradle-type fixtures, for holding the components, and is actuated by air-cylinders which are interlocked with the machine from which the parts are being delivered.

Firstly, the parts pass into an 840-gall. capacity spraying tank, which, in conjunction with the solvent used, is steam-heated to a temperature of 140 to 200 deg. F. The tank is of welded steel construction, and the heat is retained by 2-in. thick insulation blocks covered with a ¼-in. thick layer of mastic insulating material. Parts are sprayed by 22 nozzles, which are supplied with solvent by a 3-h.p., motor-driven, centrifugal pump, capable of delivering 45 gall. per min. at a pressure of 45 lb. per sq. in. A 1,800 cu. ft. per min. capacity exhausting fan, driven by a ¼-h.p. motor, removes the steam mist which is formed at this stage, and delivers it, through ducting, to the outside atmosphere. From the washing stage, the parts pass to a drying chamber, where air is delivered from a second set of 22 nozzles. It is claimed that this treatment completely cleans and dries each part, and that no intermediate rinsing is required.

The particular motor car transmission shafts already mentioned are handled, with this equipment, at a rate of 240 per hour. Each machine is built to the customer's specific requirements, but is assembled from standard components, and is readily adaptable to a wide range of applications.

Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, are the agents in this country for the Michigan Tool Co.

Some Exhibitors at the Gauge and Tool Exhibition

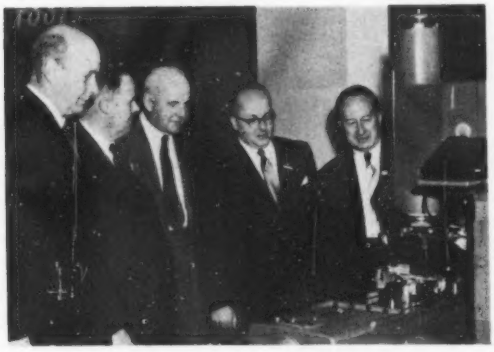
The names of those appearing in the photographs are given from left to right in all instances

MR. G. W. WOOD, MR. L. C. HAYWARD, MR. P. B. ASHTON and MR. E. B. SMITH (Firth Brown Tools, Ltd.)

MR. H. BOLSOVER (Protolite, Ltd.), MR. A. WOOD, MR. R. J. WILLIS, and MR. F. A. KENWARD (C. E. Johansson, Ltd.)

MR. C. J. LINZELL, MR. H. PITT and MR. L. F. EVE (Crawford Collets, Ltd.)

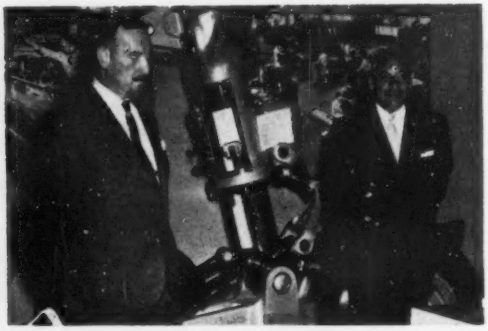
MR. W. WINDLEY and MR. E. WINDLEY (Windley Brothers, Ltd.) and MR. A. F. PICKERING (*Machinery*)



MR. A. W. JAMES, MR. W. H. FOSTER, MR. L. A. B. CRYER, and MR. C. R. O. ORR (Coventry Gauge & Tool Co., Ltd.), and MR. H. MADELEY (Brooke Tool Manufacturing Co., Ltd.)

MR. T. HAMILTON and MR. D. GILES (Clearing Machine Corporation, U.S.A.), MR. F. PERRY, MR. R. H. HAAS and MR. J. M. BRICE (Rockwell Machine Tool Co., Ltd.)

MR. E. C. SEED, MR. M. BOLLINGTON, and MR. H. SHUFFLEBOTTOM (Cowlishaw, Walker & Co., Ltd.)



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MR. J. STATHAM, MR. G. GAUNT, MR. T. N. WOOF, M.C., and MR. A. E. RANDALL (B.S.A. Tools Group), and MR. G. F. COLE (Vono, Ltd.)

MR. G. H. GOODBAN and MR. L. E. STRANGE (Elgar Machine Tool Co., Ltd.), MR. J. L. SHAW (A. Shaw & Son (Diamonds), Ltd.), and MR. CLIVE WASSELL (*Machinery*)

MR. P. H. CRAMPTON, MR. C. S. WILKINSON, MR. J. LOWTHER and MR. K. BRAUNSCHWEILER (Notsa Engineering Co., Ltd.), MR. F. W. COOPER (Taylor, Taylor & Hobson, Ltd.) and MR. A. SMITH (Société Genevoise, Ltd.)

MR. A. L. DENNISON, MR. W. T. O'DRISCOLL, MR. H. L. WEEDEN and MR. E. V. PRESTON (Birmingham Tool & Gauge Co., Ltd.), MR. C. PRANGNELL and MR. G. GOULD (Aviation Developments, Ltd.)

MR. A. F. DANIELS and MR. C. J. TURNBULL (Engineering Products, Ltd.)

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MR. A. D. GREENGROSS, MR. M. P. GREENGROSS and MR. B. ROBERT (Indusmond (Diamond Tools), Ltd.), MR. C. S. GEORGE (Truform Gauge Co., Ltd.), and MR. A. FINER (Indusmond (Diamond Tools), Ltd.)

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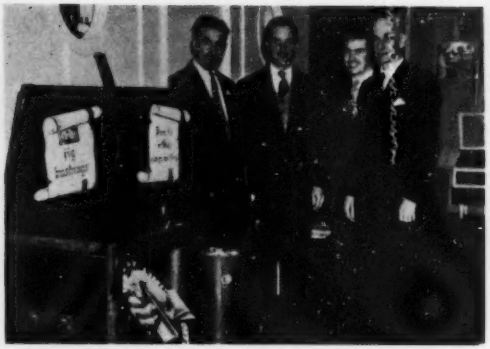

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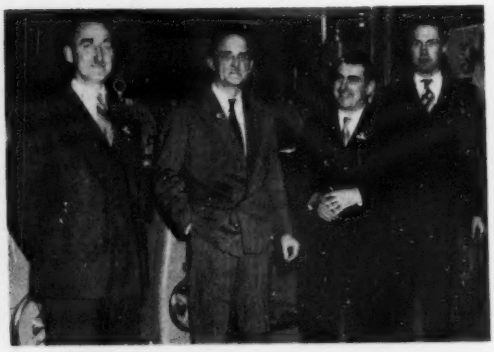

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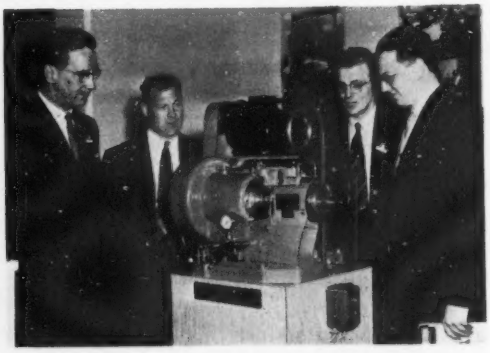

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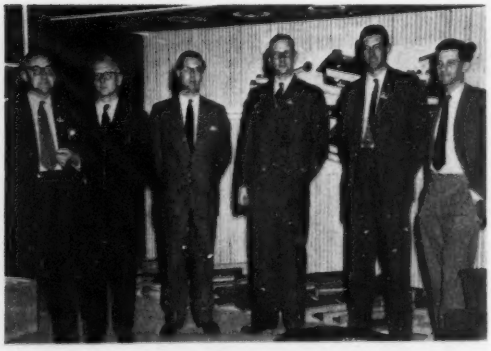

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Other photographs appear on page 1251

Hitch-feed for High-speed Lamination Presses

Fig. 1. Standard 75-ton Flexopress Employed for Blanking Laminations at a Speed of 150 Strokes per min.

A new design of hitch-feed mechanism has been applied to a standard press made by the Precision Welder & Flexopress Corporation, Cincinnati, Ohio, U.S.A., for the high-speed production of electrical laminations. This Flexofeed mechanism, it is claimed, will feed coil stock accurately at rates up to 2,500 in. per min. or more.

The standard Flexopress seen in Fig. 1 is rated at 75 tons and has a bed measuring 42 in. from left to right by 30 in. from front to back. Equipped with a standard 3-stage lamination die for piercing, blanking, and parting coil stock, the press produces two E- and two I-shaped laminations per stroke. Double-silicon-coated, grain-orientated, lamination steel, 12 in. wide by 0·012 in. thick, is fed from the coil in 15-in. increments.

It was specified that the press must operate at 150 strokes per min. With the 15-in. feed length necessary for this particular application, the feed rate is 2,250 in. of coil stock per min. The press is, however, guaranteed to feed at the rate of 2,500 in. per min., and has been operated at 3,375 in. per min. (225 strokes per min. with a 15-in. feed increment), representing more than 3 miles of material per hour. Feed length can be varied from 0 to 18 in., and coil stock up to 30 in. wide can be handled. A tolerance of ±0·005 in. has been specified for the length of material fed per stroke, but limits of ±0·002 in. are being held consistently.

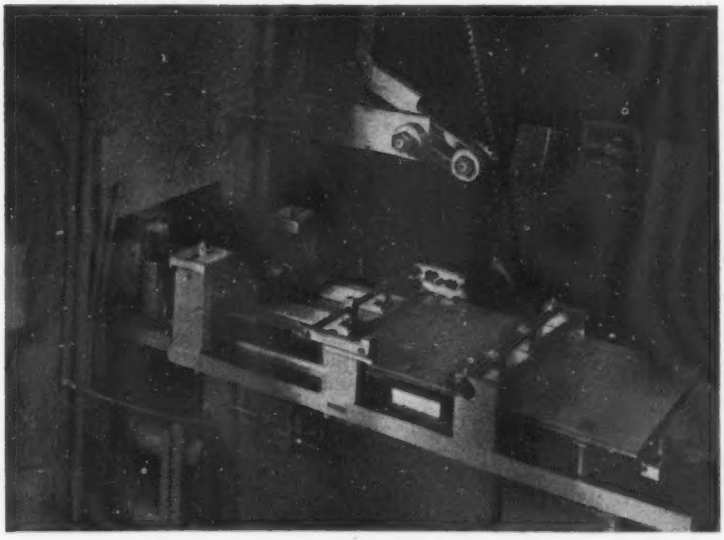

Fig. 2. Flexofeed Hitch-feed Mechanism Employed on the Press Seen in Fig. 1 to Feed Lamination Coil Stock at Rates of 2,500 in. per min., or More

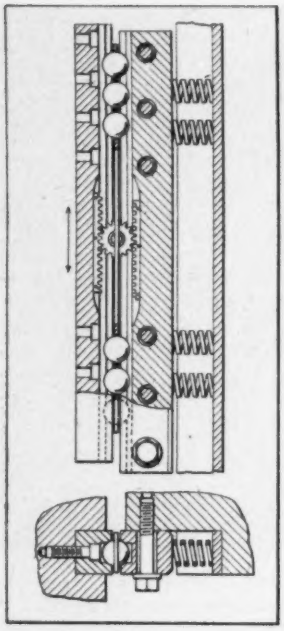

Fig. 3. Ball Guideways Employed on Flexopress to Eliminate Lateral Float. The Balls are Preloaded by Means of Calibrated Springs

The Flexofeed comprises a reciprocating head carrying a pair of spring-loaded feeding fingers which grip both edges of the stock against an anvil during the advance stroke. At the end of the feed stroke, the feeding finger housing contacts a limit switch, which actuates a stock - clamping brake. During the return stroke of the head, the feeding fingers release the stock, and a stationary pair of spring-loaded snubbing fingers prevents the material from being retracted. The brake effectively overcomes the kinetic energy of the material which is being fed.

Reciprocation of the Flexofeed head is effected by means of a rack and gear segment, which is driven by linkage from the press. The pivoted gear segment arm is slideably mounted on an adjustable eccentric to permit of varying the feed stroke. If the material being fed buckles upwards, it contacts limit switches which stop the press. The entire hitch-feed arrangement is mounted on an anti-friction elevating unit so that it can be adjusted to suit the die height. A close-up view of the feeding equipment is seen in Fig. 2.

While the press illustrated is to be used for the production of laminations, similar equipment can be employed in connection with many other operations. Changeover from one part to another can be accomplished quickly since the dies are readily accessible. Conventional dies for forming and drawing at high speeds can be used without modification, and parts requiring either long or short feed increments can be stamped from coil stock. The arrangement enables accurate feed strokes up to a maximum length of 36 in. to be obtained.

The Flexopress operates with a high degree of accuracy because it incorporates ball guides. A set of preloaded ball guideways is provided at each corner of the ram to eliminate lateral float and ram oscillation. In this way, it is stated, vertical accuracy can be held within 0·0005 in. at any point of the stroke. In addition, parallelism between the ram face and bed is maintained within 0·0005 in. per foot. With this guide design, life between die regrinds has been increased, in some instances by as much as four times.

As seen in Fig. 3, the 1-in. diameter balls ride in radiused seats ground in the hardened V-ways and are kept separated by a special retainer. The balls are preloaded by means of self-adjusting, calibrated springs. In order to obtain the necessary preloading, it is only necessary to loosen the bolts, and the springs will then apply the necessary pressure between the guideways and the balls while the bolts are again tightened.

Of welded-steel box construction, the press frame is shot-blasted and stress-relieved prior to machining. The columns and ribbing have been designed to damp out vibration when the press is running at high speed. A variable-speed motor drive is employed, and the air clutch is interlocked with the brake to provide for very rapid action.

Separation of Silver from Brazed Stainless Steel Assemblies

Where silver brazing is employed in the production of stainless steel honeycomb assemblies, it is desirable that the silver should be separated before any scrap material is re-melted. In this way, contamination of the steel with silver, and consequent lowering of its corrosion resistance, is avoided. At the same time, substantial quantities of silver can be recovered.

The Martin Co., Baltimore, Maryland, U.S.A., have estimated that there are approximately 5 troy ounces of silver in the brazing alloy used for each square foot of stainless steel honeycomb. As a result of investigations, it was found that by soaking the brazed stainless steel honeycomb panels in a tank containing 50 per cent nitric acid solution, for approximately 20 hours at room temperature, the silver was completely dissolved, and the stainless steel parts could be removed from the solution without any damage to their surfaces. In this way the scrap value of the stainless steel members is increased.

The nitric acid solution is shipped to precious metals refiners for subsequent recovery of the dissolved silver.

Schneeberger Ball and Roller Slideway Elements

The Swiss firm of W. Schneeberger A.G., Roggwil (Bern), are making a range of precision low-friction slideway elements of both ball and roller types, as seen in Fig. 1, which can be incorporated in machine tools, particularly grinders, also in other kinds of equipment where a sensitive and accurate movement is required. These elements were developed originally for use in grinding machines of various types which the company make, and the success achieved has led to their introduction for wider application. In many cases, they can readily be fitted to existing machines.

If required, the ball-type elements can be supplied without cages, and both the ball and roller types are available in six sizes of cross section, and in lengths up to 3 ft. The cage-less units, known as type K, incorporate balls of diameters from ½ to 2 in., and in the type KK, which are provided with cages, the balls range from ⅜ to 1½ in. diameter. The six roller-type elements available are fitted with rollers from 6 to 24 mm. (0·236 to 0·945 in.) diameter.

A specially-selected, non-warping steel is employed for the V-grooved slideway members, which are hardened, and ground all over to close limits of accuracy for straightness and parallelism, the maximum error being 0·00004 in. in 8 in. The

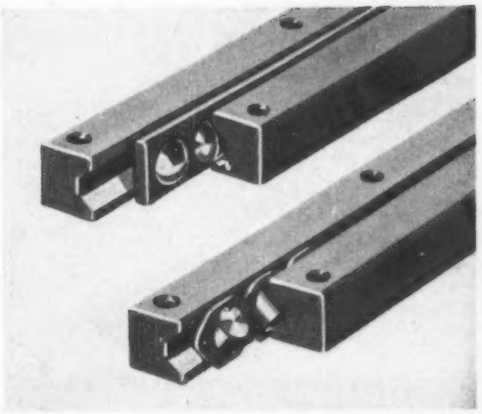

Fig. 1. Schneeberger Ball- and Roller-type Slideway Elements

cages, which are made of steel, are unhardened, and for the roller-type element, are composed of pivoted links.

A typical assembly arrangement suitable for either ball- or roller-type slideway elements is shown in Fig. 2. The V-grooved slideways, it may be noted, can be supplied with the fixing holes either plain drilled, drilled and counterbored, or tapped, according to requirements. Adjustment for the elimination of play in the slideway assembly is very simply effected by means of sets screws *A*, at one side. It is, of course, essential that the seating faces *B*, *C*, and *D* should be machined accurately square and flat. Another important requirement is that the slideway should be protected against the ingress of dirt and swarf, and such protection may be afforded, for example, by means of a cowl extension, as at *E*. Tapped holes can be provided in the ends of the V-grooved slideway members to take stop plates for limiting the traverse movement.

Fig. 3 shows a Schneeberger double-wheel grinder for

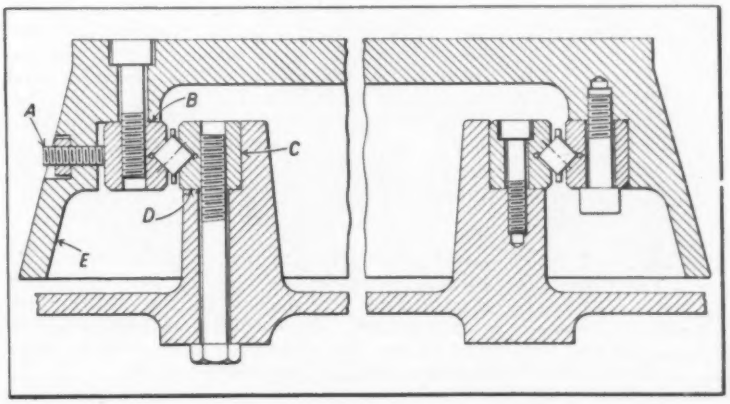

Fig. 2. Typical Mounting Arrangement for the Schneeberger Slideway Elements

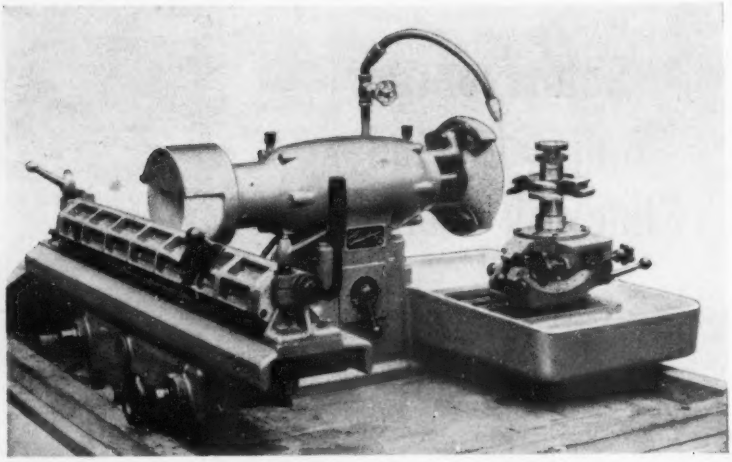

Fig. 3. Schneeberger Double-wheel Tool Grinding Machine which Incorporates Slideway Elements

sharpening woodworking routing cutters and machine knives. The worktable for the latter, on the left, is fitted with roller-type slideways incorporating rollers of 9 mm. (0·354 in.) in diameter, and it has a traverse of 3 ft. Roller slideways of the same type are employed for the cutter fixture on the right, which has a stroke of 7 in. The company also makes a grinding and lapping machine for tungsten-carbide tools which incorporates these guideways, and they are extensively employed in machines for the optical industry. In addition, they have been applied to a machine built by the Hammond Co., Kalamazoo, U.S.A., for use in the manufacture of printing blocks.

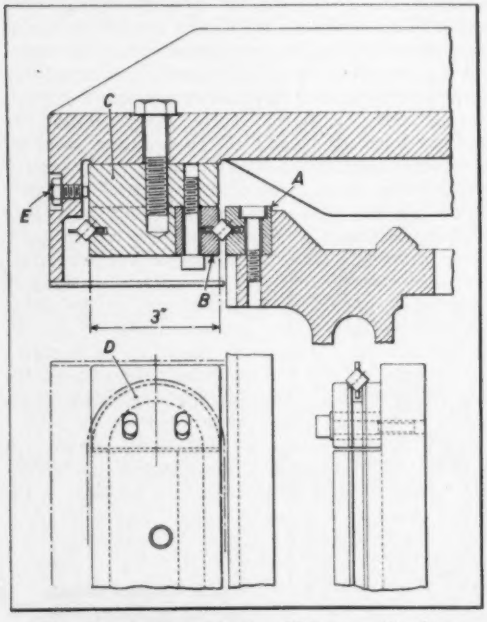

Fig. 4. Arrangement of a Slideway with Circulating Rollers

As already stated, the cage employed for the roller-type elements is of a pivoted-link construction, and this feature enables slideways to be so constructed that the rollers circulate, as shown in the drawing Fig. 4. These circulating crossed-chain roller bearings are used for long-stroke applications where moving parts may have considerable overhang, or in designs where the overall length of the slide is shorter than the stroke. Referring to Fig. 4, the stationary V-grooved members *A* are fastened in the normal manner, and those for the moving part *B* are carried, as seen at *C*, in cast-iron or steel blocks, which, in turn, are fastened by screws to the moving part. The blocks *C* serve merely to guide and support the return run of the roller chain, which passes over separately-mounted radiused blocks *D*, at each end. These end blocks are provided with slotted fixing holes which enable them to be adjusted to tension the roller and cage assembly. Adjustable set screws, as at *E*, are provided at one side of the slideway assembly, and these are used in order to eliminate any play.

The full range of Schneeberger anti-friction slideway elements are marketed in this country by Engineering & Scientific Equipment, Ltd., 33 Minster Road, London, N.W.2.

THE PRODUCTION OF WHEELED INDUSTRIAL AND AGRICULTURAL TRACTORS during January of this year reached a total of 12,035, of which 8,431 were exported. These figures represent increases over those for January, 1957, which were 11,279 and 8,247, respectively.

Orcutt Grinding Machine for Internal Helical Gears

The Gear Grinding Co., Ltd., Cranmore Boulevard, Shirley, Birmingham, have introduced an internal helical gear grinding machine, shown in the accompanying illustrations, which has been developed primarily for finishing the teeth of annulus reduction gears for aircraft turbo-propeller engines. The machine operates on the well-established Orcutt formed-wheel principle whereby the work is indexed from tooth to tooth, and the flanks and roots are ground by means of a wheel dressed to the profile required. With this method, rapid production is obtained, and the design of the machine is such that the exceptionally high degree of accuracy, as regards lead, profile, tooth spacing and surface finish, specified for these aircraft gears, can readily be maintained.

A general view of the machine is given in Fig. 1. Internal gears from 10 to 24 in. inside diameter, with numbers of teeth from 45 to 240, and diametral pitches from 5 to 10 can be ground, the maximum helix angle being 27 deg., and the maximum face width, approximately 4 in.

Referring to the close-up view, Fig. 2, the wheel-head is overhung from an outer vertical slide, carried, in turn, on a main slide, whereby increments of down feed are applied by hand, and the workpiece, mounted in a pot-type fixture on the horizontal-spindle work-head, is reciprocated past the wheel. This reciprocating motion, at steplessly-variable speeds, is effected by means of a hydraulic cylinder and piston, and pressure oil is supplied by a self-contained Vickers-Detroit pump unit located outside the machine and connected by flexible pipes to a control valve panel. In

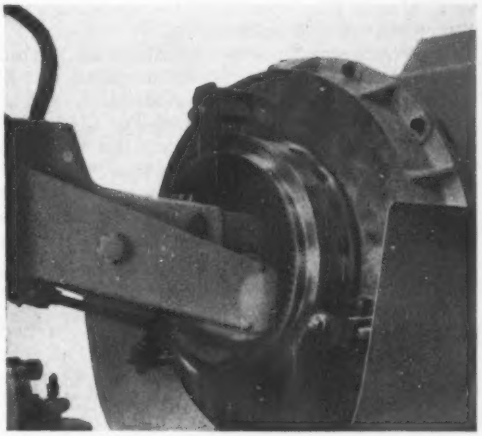

Fig. 2. Close-up View, Showing the Disposition of the Grinding Wheel-head and the Workpiece on the Orcutt Internal Helical Gear Grinder

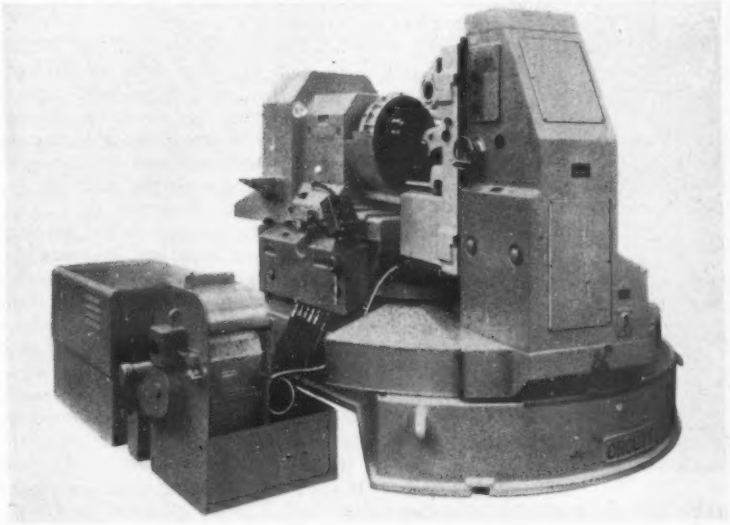

Fig. 1. Orcutt 24-in. Capacity Internal Helical Gear Grinder

the opposite side of the work-head is housed the electrical control panel, which incorporates safety interlocking features to ensure a correct operating sequence.

Indexing of the work, which takes place after each stroke, is effected automatically by a 24 in. diameter notched index plate, the latter being ground to a dividing accuracy of two seconds of arc. A view from the rear of the work-head, with the covers open, is given in Fig. 3.

The work spindle assembly rotates in precision roller bearings and consists of an inner spindle, to which the index plate is attached, and an outer spindle carrying the base disc of the lead generating mechanism. This base disc is secured by steel tapes to a horizontal, transverse slide, and on the underside of the latter there are two pairs of rollers which straddle an adjustable sine bar attached to a graduated disc mounted on the machine base. It is stated that lead generation to an accuracy of 0·0001 in. per inch of face width can be obtained in this manner.

In addition, the outer spindle carries a fixed arm, and a moving arm which is free to pivot about the axis, the two arms being connected by means of a hydraulic cylinder and piston. Normally, these arms are locked together by pressure in the cylinder. The pivoted arm carries the index pawl, which is held in engagement, hydraulically, with a notch in the index plate by pressure transmitted from the cylinder which locks the two arms together. A slave pawl, arranged to pivot freely about the same axis as the indexing pawl, is provided, which rests by its own weight in the same notch of the index plate and serves to actuate a micro-switch.

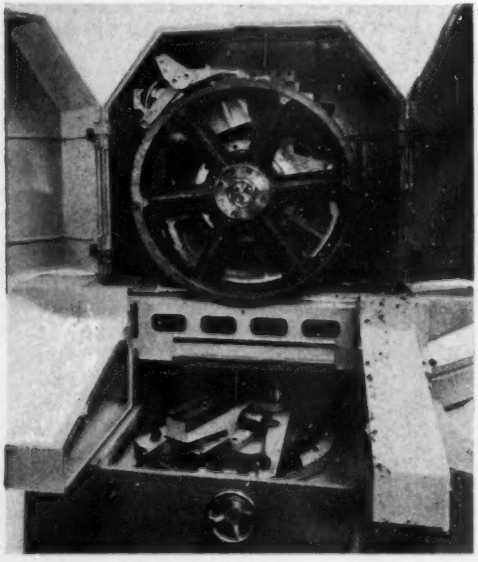

Fig. 3. View of the Work-head from the Rear, with Covers Open to Show the Indexing and Lead Generating Mechanism

At the beginning of the indexing cycle, the main pawl is lifted out of the notch hydraulically, and further movement of the piston in the cylinder then causes the arm carrying the pawl to pivot about the work spindle. When the slave pawl reaches another notch in the index plate, it moves down freely into engagement, and the resulting operation of the associated micro-switch energizes a solenoid valve whereby oil is admitted to the opposite end of the hydraulic cylinder, to effect the indexing motion. At the end of the stroke, the fixed and moving arms on the work spindle are securely locked together by hydraulic pressure in readiness for the next grinding stroke, during which the entire work spindle assembly is rotated under the control of the lead generating mechanism.

Grinding wheels up to 8 in. diameter can be employed, and the spindle, of rigid design, is mounted at each side of the wheel in Glacier precision plain bearings. A plain end thrust bearing is provided. It is not necessary to disturb the bearing housings when changing a grinding wheel, the arrangement being such that the entire wheel spindle assembly can be taken out, after the two bearing caps have been removed.

The wheel-head is detachable from the vertical slide and is supplied in either right- or left-hand form, according to the hand of the internal gear helix. Power adjustment by means of a push-button controlled motor is provided for setting the column carrying the wheel-head and slide assembly to the required helix angle on the machine bed with reference to a scale and vernier.

The grinding wheel is formed to the shape of the tooth space by two separate, hydraulically-operated diamond dressing mechanisms controlled by pantograph and templates. One mechanism dresses the flank form on the faces of the wheel, and the other, the root form on the wheel periphery. Both dressing mechanisms are housed in a slide which is moved hydraulically to the working position along horizontal guideways on a knee bracket at the lower end of the main wheel-slide. Provision is made for easy removal of the template unit to facilitate changing and setting the templates.

Duplicate control panels are provided on each side of the wheelhead column and two knobs

enable steplessly-variable fine and coarse dressing feed rates to be selected. When the "trim" push-button is depressed, the clamps of the outer slide carrying the grinding head are released hydraulically, the slide moves downwards by a pre-determined amount, and the clamps are applied again by spring pressure. The dressing slide is then moved to its extreme forward position to bring the flank-forming diamond beneath the wheel, and both faces of the latter are dressed at a single pass. Next, the slide moves back a fixed amount, and the second diamond comes into operation to form the wheel periphery. The fine and coarse dressing feed rates are brought into operation by a switch on the control panel, and there is another selector switch with "single trim" and "repeat trim" positions which enables as many dressing passes as required to be taken.

Push button controls for starting and stopping the machine cycle are housed in panels conveniently located on each side of the work-head base, and provision is made for selecting continuous indexing, or work indexing at the end of each stroke, or for eliminating the indexing motion altogether.

The separately-mounted hydraulic supply unit of the machine incorporates two vane-type constant-delivery pumps, driven by a single electric motor. The larger pump delivers 12 gal. of oil per min. and supplies the work slide circuit only, the maximum operating pressure being 300 lb. per sq. in., which provides for traverse speeds up to 30 ft. per min. The smaller pump has a capacity of 2 gal. per min. and supplies oil at a maximum pressure of 250 lb. per sq. in. for the pilot and auxiliary circuits of the machine. A Barnesdril filter, of the combined magnetic and traversing fabric type, is provided in the coolant system.

Trade Publications

THOR HAMMER CO., Highlands Road, Shirley, Birmingham.—Folder giving particulars of the company's range of soft-faced hammers. Facing materials include copper, rawhide, cellulose, and plastics.

GEORGE TAYLOR & SON (ENGINEERS), LTD., Swan Lane, Coventry.—Folder devoted to the company's range of screw and plain plug and ring gauges. Screw gauges can be supplied in right- and left-hand and in standard and non-standard forms. The sole agents are Brooks & Walker, Ltd., 47 Great Eastern Street, London, E.C.2.

CAULKING SERVICES, LTD., 36 Great Queen Street, London, W.C.2.—Folder concerned with a new adhesive which is being marketed under the name Pitabond. Various advantages are claimed for this preparation, which is said to be suitable for application to cement, bricks, plaster, asbestos, glass, metals, wood, and other materials.

THE CLAYTON CRANE & HOIST CO., LTD., Irwell Chambers, Union Street, Liverpool, 3.—Folder giving brief descriptions of the company's products, with illustrations showing typical applications. In particular, attention is drawn to the Cadet 2-speed, hook-on wire rope hoist, and the Micro Speed unit for precision dead-slow hoisting, lowering, and travelling.

TAP SHARPENERS, LTD., 21B Station Road, Cheadle Hulme, Stockport, Cheshire.—Illustrated folder giving the specification of the Finny tap nose lead grinder which has a capacity for work up to 5 in. diameter by 18 in. long. It is stated that the machine can be readily adapted for accurately grinding and relieving stepped drills and the nose leads of reamers and centre drills.

DENFORD SMALL TOOLS (BRIGHOUSE), LTD., Victoria Works, Birds Royd, Brighouse, Yorks.—Catalogue of the firm's products which include the 5-in. Viceroy Educator Lathe; the Viceroy 12-in. double-ended cabinet and 10-in. double-ended pedestal grinders; high-speed steel toolholder bits, and a 4-way tool post. Also leaflets concerned with D.S.T. toolholders of a variety of types, and the Viceroy mahogany tool cabinet.

UNION CARBIDE, LTD., Alloys Division, 103 Mount Street, London, W.1.—Publication entitled "product sketches" which gives brief particulars of more than 160 different ferro alloys and metals now handled by this division. Sections are devoted to chromium, silicon, manganese, zirconium, briquetted alloys, boron, calcium, columbium, titanium, tungsten, and vanadium.

CLAUDE LYONS, LTD., Valley Works, 4-10 Ware Road, Hoddesdon, Herts.—Consolidated net price list and buying guide covering the following products of the company: Variac voltage-adjusting transformers; Bat fixed mains transformers and decade-condenser boxes; Bat A.C. automatic voltage stabilizers and motor-operated automatic voltage regulators.

NEWMARKET TRANSISTOR CO., LTD., Exning Road, Newmarket (the sales organization in this country for Pye Industrial Electronics, Ltd.).—Booklet entitled "Transistor Information", which includes sections on small signal parameter definitions, resistance measurements, and operating limits. In addition, the publication includes tentative specifications for audio, radio frequency, and power series transistors.

POWER JACKS, LTD., Maylands Avenue, Hemel Hempstead, Herts.—Well-arranged and informative brochure on Newton hydraulic clamping. The clamping principle is first explained and a typical installation is described, also various methods of applying clamping pressure. Folding plates are then devoted to the available cylinders and pumps with specifications. In addition, there are sheets concerned with hydro-pneumatic intensifiers, pipe fittings, and mounting brackets.

News of the Industry

Halifax

MACHINE TOOL MAKERS, generally, continue to experience the reduced inflow of new business which has been characteristic of recent months. Most firms have orders in hand which will ensure normal hours of working for some time ahead, but week-end and overtime operating is now strictly limited to particularly urgent needs. Enquiries for machine tools are coming to hand steadily, and it is felt that many contracts, for which tenders have already been submitted, would come to fruition with an easing of prevailing financial restrictions, and this applies to both the home and export markets.

JOHN STIRK & SONS, LTD., Boothtown, are busy with the production of double-standard and open-side-type planing machines which range in widths from 42 in. to 10 ft. Several machines with widths from 7 to 10 ft. are on order, among which we may note a 10-ft. wide planer equipped with tandem tables, each 20 ft. long. We hope shortly to make further reference to a 26- by 10- by 9½-ft. openside planer which has recently been despatched to New York. Export orders are in hand for Australia, India, Pakistan, Italy and Sweden. The latest addition to plant is a Churchill slideway grinding machine, and a 10-ton cupola is being installed in the foundry.

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After formally opening the fifth exhibition of the Gauge and Tool Makers' Association at Olympia, Sir William Lyons (right), managing director of Jaguar Cars, Ltd., made a tour of the stands accompanied by the President of the Association, Mr. F. W. Halliwell, C.B.E., M.I.Mech.E., M.I.Prod.E. (centre)

COVENTRY MACHINE TOOL WORKS, LTD., Boothtown, have a good programme of Covmac horizontal hot forging machines in hand, in sizes up to 4 in. bar capacity. Our attention was drawn to a machine for Australia, for forging motor car rear axles, and to a fully-automatic 1-in. capacity bar machine, also destined for Australia. Three sizes of hot sawing and milling machines are also produced at these works, for sawing bars up to 2, 3 and 4 in. diameter, and for use in forging and drop-stamping plants.

S. APPLEYARD & CO., Boothtown, report a lessened demand for standard single- and double-ended punching, shearing and angle cropping machines. Recent orders cover special machines for garage and constructional engineers' use, and a special punching and shearing machine destined for Nepal, for operating on cupro-nickel. There is a regular demand for spares in the form of shear blades, punches and dies.

GEORGE SWIFT & SONS, LTD., Claremount, in addition to the office extensions, which are progressing, have in hand a new heavy lathe erection shop measuring 250 by 50 ft. which, it is hoped, will be completed by the end of the year. This shop will be equipped with two Vaughan 25-ton overhead electric travelling cranes. Lathes on order range from 8½- to 36-in. centres, and include T-bed types, and machines fitted with hydraulic copying equipment. Our attention was drawn to a special 21-in. centre crankshaft turning lathe, which we hope to describe more fully at a later date, and to a 21-in. centre piston ring turning lathe.

OLDFIELD & SCHOFIELD CO., LTD., Boothtown, are engaged in the production of standard lathes ranging from 10½- to 18¾-in. centres, also railway wheel and axle lathes, some of which are destined for British Railways, and others for India and Australia. We also noted a 72-in. swing crane drum turning lathe, and a batch of re-turning and grinding lathes, the latter being on order for British Railways, for converting axles to take Timken roller

bearings, in connection with the diesel locomotive programme. We hope to describe one of these machines shortly. Other products include various sizes of straightening presses up to 60 tons capacity.

STANLEY MACHINE TOOL CO., LTD., New Bank, have home and export orders in hand for standard lathes ranging from 7½- to 14½-in. centres, and for sliding bed lathes of 10½-, 12½- and 14½-in. centres. We may note export business with Canada, India, South Africa and Portugal. The smaller lathes are now being built with straight beds and with aprons which conform to Canadian and U.S.A. requirements. In a new brochure, the firm's latest designs of 10½- and 12½-in. centre lathes are described. A Stirk 12-ft. by 4-ft. by 3-ft. 6-in. double-housing planing machine has recently been installed.

JOHN MITCHELL & CO. (HALIFAX), LTD., Godley Ironworks, are chiefly employed on the production of 8½-in. centre all-geared head lathes, with beds 6, 8 and 9 ft. long. To provide increased capacity, the lathe centres can be raised to 9⅛ and 10⅛ in. An interchangeable hexagon turret can be supplied in addition to the normal 4-tool post, and mechanical forming attachments can be fitted. We are asked to point out that this firm has no connection with D. Mitchell & Co., Ltd., Keighley.

DENHAM'S ENGINEERING CO., LTD., Holmfield, have standard lathes on order ranging from 16 to 40 in. swing, some of which are fitted with hydraulic copying equipment. Our attention was drawn to a 20⅜-in. centre lathe on order for a North-East Coast shipyard, which has interchangeable, swivelling, hydraulic copying slides, for profile boring marine diesel engine piston heads. Another interesting lathe, of 16⅜-in. centres, with a 14-in. bore spindle, which is destined for the Rhodesian Copper Mines, has twin gaps in the bed to accommodate railway wagon wheel sets for tyre re-turning operations. We also noted a 20⅜-in. swing lathe, which admits 28 ft. between centres, and has a 45-h.p. motor drive. This machine has strengthened tool slides and power motion to top slide, and is the third of its type ordered by a Midlands forge.

Other work includes a 14-in. centre lathe for the R.O.F. factory at Nottingham, two 8⅜-in. lathes for the I.C.I. plant at Billingham, two 8⅜-in. lathes for the British Transport Commission for Hull Docks and a 22-in. swing lathe for the Blyth power station. Mention may also be made of four 8⅜-in. centre lathes, which will be employed for turning the tips of Nimonic turbine blades, and have spindle speeds from 3 to 100 r.p.m., and a 22-in. swing SR10V type lathe has recently been supplied to the Atomic Energy Authority. In course of development is an 18⅜/20⅜-in. centre lathe of the slow-speed, heavy-duty type, for use in heavy steelworks, shipyards and marine engineering shops. This lathe has 24 spindle speeds, ranging from 1⅛ to 220 r.p.m., the drive for the slower speeds being taken through a ring gear. The lathe accommodates a 36-in. diameter, 4-jaw chuck, and a 54-in. diameter faceplate fitted with loose jaws. It is proposed to show a 16-in. swing SR8V lathe with hydraulic copying equipment, a 22-in. swing SR10V lathe, and an 8⅜-in. centre lathe at a Machine Tool Exhibition which is to be held in Australia next year.

WILLSON LATHES, LTD., Ovenden, in view of a reduced demand for their standard range of lathes, are undertaking an increasing amount of lathe reconditioning work.

BINNS & BERRY BROS. (HALIFAX), LTD., Ovenden, have home and export orders in hand for lathes ranging from 6½- to 12½-in. centres, including the new 10⅜-in. centre JB type lathe, described in MACHINERY, 92/862—11/4/58. Other work includes a batch of thread whirling machines of new design, and a precision pitch measuring device and electronic pitch correcting mechanism for the thread whirling machines are in course of development. Export orders have lately been received from Australia, South Africa, and South America, among other countries. Recent additions to plant include a Ward 3A capstan lathe and single-purpose, semi-automatic, horizontal boring machines, with interchangeable jig plates, for operations on headstocks and gearboxes.

HALIFAX RACK & SCREWCUTTING CO., LTD., Ovenden, are steadily employed on the cutting of racks and traverse screws, including thread-whirled screws. Our attention was drawn to the first of three electronically-controlled automatic rack cutting machines which has recently been installed. This machine was built by the associated Binns & Berry Bros. (Halifax), Ltd., and we hope to describe it at a later date. H. B.

Obituary

MR. A. H. WAINE, a director of Hadfields, Ltd., and the managing director of the associated company, Hadfields Forgings, Ltd., died recently in Brussels, while on a business tour of the Continent, at the age of 57. He had been with the company for more than 40 years, and was appointed a local director in 1945, when he was heat treatment manager at both the Hecla and East Hecla Works. In 1948 he became a director of Hadfields Foundry & Engineering Co., Ltd., and two years later he was appointed to the board of Hadfields, Ltd.

BRITISH MACHINE TOOL

Exports of New Machine Tools

Countries	Vertical Boring Machines		Other Boring Machines		Drilling Machines		Grinding, Lapping and Honing Machines		Automatic Lathes		Capstan and Turret Lathes		Other Lathes		Screwing Machines	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Commonwealth																
South Africa	—	—	7 (1)	355	927 (99)	18,523	650 (97)	17,271	280 (1)	15,984	224 (5)	8,994	965 (80)	33,116	—	—
India	507 (1)	13,116	441 (13)	14,162	1,337 (25)	51,422	1,452 (25)	52,167	156 (3)	11,911	1,237 (29)	43,941	707 (29)	21,350	79 (3)	5,619
Pakistan	295 (2)	7,893	3 (2)	426	29 (75)	1,030	38 (7)	1,168	—	—	4 (1)	395	26 (1)	1,113	—	—
Australia	26 (1)	1,000	551 (4)	14,191	880 (40)	19,474	640 (14)	23,452	681 (10)	28,822	770 (37)	30,166	1,617 (43)	50,048	97 (5)	4,592
New Zealand	—	—	—	—	69 (9)	1,600	112 (115)	3,695	—	—	46 (1)	3,594	538 (21)	14,881	—	—
Canada	—	—	—	—	864 (13)	17,266	170 (9)	6,849	30 (3)	5,021	62 (2)	2,420	895 (19)	27,548	—	—
Miscellaneous	6 (3)	176	13 (4)	830	501 (86)	10,835	210 (43)	6,842	—	—	59 (3)	1,698	1,160 (47)	39,201	87 (3)	2,919
Foreign																
Soviet Union	—	—	—	—	—	—	—	—	—	—	76 (2)	3,627	—	—	—	—
Sweden	—	—	—	—	528 (3)	10,969	204 (6)	9,559	—	—	242 (23)	9,022	—	—	—	—
Norway	—	—	3 (1)	85	—	—	5 (7)	260	—	—	—	—	27 (27)	1,091	—	—
Denmark	—	—	—	—	225 (2)	4,709	—	—	—	—	43 (1)	1,853	32 (9)	1,772	—	—
Western Germany	—	—	—	—	—	—	2 (1)	695	232 (2)	13,283	—	—	17 (1)	1,486	—	—
Netherlands	330 (2)	6,590	3 (1)	375	142 (11)	3,306	25 (17)	1,148	—	—	339 (6)	11,010	92 (6)	3,677	—	—
Belgium	—	—	—	—	268 (14)	5,536	81 (2)	3,384	—	—	250 (6)	9,476	93 (12)	3,817	—	—
France	—	—	191 (2)	18,311	32 (1)	2,637	33 (8)	1,151	—	—	265 (2)	9,074	—	—	—	—
Switzerland	—	—	—	—	48 (2)	1,462	46 (4)	1,977	—	—	91 (2)	3,749	35 (11)	1,279	3 (1)	137
Spain	—	—	50 (1)	4,351	465 (5)	13,058	1 (1)	148	140 (1)	6,765	38 (1)	1,583	—	—	—	—
Italy	—	—	3 (2)	537	—	—	8 (4)	2,148	256 (1)	13,285	—	—	—	—	—	—
U.S. America	118 (1)	3,311	—	—	397 (5)	6,530	70 (3)	2,477	—	—	80 (1)	1,050	1,347 (68)	40,789	86 (3)	3,900
Miscellaneous	170 (1)	4,746	148 (6)	7,841	726 (105)	18,066	252 (42)	12,237	198 (4)	18,498	382 (10)	14,163	1,069 (73)	33,163	116 (6)	4,135
Total	1,452 (11)	36,832	1,413 (37)	61,464	7,438 (495)	186,423	3,999 (405)	146,628	1,973 (25)	113,569	8,620 (132)	155,815	8,620 (447)	274,331	468 (21)	21,302

Total exports of reconditioned machine tools:—Quantity: No. 155; weight, 9,676 cwt.; value, £44.215.

Total exports of imported machine tools:—Quantity: No. 12; weight. 1.361 cwt.; value, £36,601.

Imports of New Machine Tools

Country of Origin	Boring and Broaching Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Automatic Lathes	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Western Germany	455 (6)	20,409	195 (24)	8,242	30 (4)	1,998	1,121 (45)	64,589	2,647 (42)	100,959
Belgium	—	—	—	—	—	—	—	—	—	—
France	134 (1)	4,407	—	—	—	—	61 (3)	3,044	720 (11)	41,809
Switzerland	206 (5)	17,809	73 (13)	5,278	32 (7)	4,686	449 (28)	37,874	994 (30)	71,859
U.S. America	21 (3)	2,617	—	—	67 (1)	6,223	939 (9)	89,886	452 (5)	28,850
Miscellaneous	1,945 (10)	40,266	242 (7)	2,602	2 (1)	784	510 (22)	33,939	1,087 (12)	38,922
Total	2,761 (25)	85,508	510 (44)	16,122	131 (13)	13,691	3,080(107)	229,332	5,900(100)	282,399

Total imports of reconditioned machine tools: Quantity: No. 21; weight, 2,694 cwt.; value, £43,470.

IMPORTS AND EXPORTS (Classified)

and Parts during January, 1958

Threading Machines		Milling Machines		Gear-cutting Machines		Planing, Shaping and Slotting Machines		Presses		Sheet Metal-working Machines		Sawing Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
33 (2)	818	374 (7)	15,483	—	—	236 (6)	11,403	585 (18)	14,519	—	—	53 (5)	1,222	1,465 (44)	20,522	280	15,969	6,079 (365)	174,179
30 (1)	1,167	238 (5)	12,327	—	—	1,213 (4)	24,995	1,323 (15)	22,006	15 (2)	272	13 (1)	415	899 (81)	25,400	196	18,454	9,843 (237)	318,724
—	—	98 (2)	4,495	—	—	—	—	190 (1)	2,313	—	—	15 (3)	437	541 (3)	12,634	16	673	1,255 (97)	32,577
196 (10)	14,762	745 (21)	32,828	—	—	2,902 (8)	54,037	9,149 (35)	151,174	76 (1)	3,858	194 (3)	3,991	84 (44)	2,845	768	36,370	19,376 (276)	471,610
—	—	76 (3)	1,445	—	—	50 (2)	1,089	366 (49)	6,498	19 (2)	417	22 (12)	541	123 (28)	2,734	90	4,028	1,511 (242)	40,522
—	—	207 (7)	7,728	395 (1)	16,042	210 (7)	4,318	—	—	—	—	235 (11)	4,933	448 (10)	10,596	363	16,460	3,879 (82)	119,181
	—	189 (3)	10,982	—	—	703 (13)	13,039	189 (12)	4,734	24 (4)	889	131 (16)	2,980	160 (26)	4,852	212	10,352	3,644 (263)	110,329
—	—	—	—	—	—	—	—	—	—	—	—	—	—	39 (2)	2,055	—	—	115 (4)	5,682
—	—	3 (2)	613	—	—	—	—	—	—	—	—	—	—	613 (1)	5,729	20	2,265	1,610 (35)	38,157
—	—	—	—	—	—	—	—	1 (1)	28	—	—	—	—	—	—	34	1,296	70 (36)	2,760
—	—	—	—	—	—	19 (1)	388	3 (1)	140	—	—	—	—	34 (2)	3,718	26	1,381	382 (16)	13,961
75 (1)	5,818	3 (1)	275	—	—	70 (1)	2,815	—	—	—	—	—	—	610 (1)	21,005	486	11,961	1,495 (8)	57,338
—	—	120 (1)	5,729	—	—	—	—	244 (3)	2,777	4 (1)	140	52 (4)	863	24 (6)	1,138	28	2,058	1,403 (58)	38,811
—	—	—	—	—	—	16 (3)	432	95 (1)	4,200	—	—	— (1)	16	135 (3)	2,923	54	2,935	992 (42)	32,719
—	—	100 (1)	5,326	341 (4)	19,757	—	—	1,750 (6)	39,385	—	—	—	—	1,271 (23)	40,049	213	13,541	4,196 (47)	149,231
103 (1)	6,008	95 (1)	4,827	—	—	—	—	47 (3)	908	—	—	—	—	20 (3)	1,582	39	2,338	527 (28)	24,267
—	—	—	—	—	—	—	—	—	—	—	—	—	—	408 (3)	8,527	21	3,519	1,123 (12)	37,951
—	—	243 (1)	8,123	1,300 (1)	37,697	—	—	2,030 (3)	37,104	12 (1)	875	—	—	183 (1)	7,495	137	10,256	4,172 (14)	117,520
174 (5)	8,870	194 (7)	7,723	75 (1)	5,800	1 (1)	35	—	—	—	—	7 (2)	235	168 (7)	10,507	462	11,437	3,179 (104)	102,664
19 (1)	471	554 (6)	30,739	—	—	214 (10)	4,260	738 (81)	28,009	197 (28)	4,652	47 (7)	1,580	1,119 (28)	27,372	545	21,014	6,494 (408)	230,946
630 (21)	37,914	3,239 (68)	148,643	2,111 (7)	79,296	5,634 (56)	116,811	16,710 (229)	313,795	347 (39)	11,103	769 (65)	17,213	8,344 (316)	211,683	3,990	186,307	71,345 (2374)	2,119,129

Figures in parentheses denote number of machines. * Not including machine-tool cutting parts.

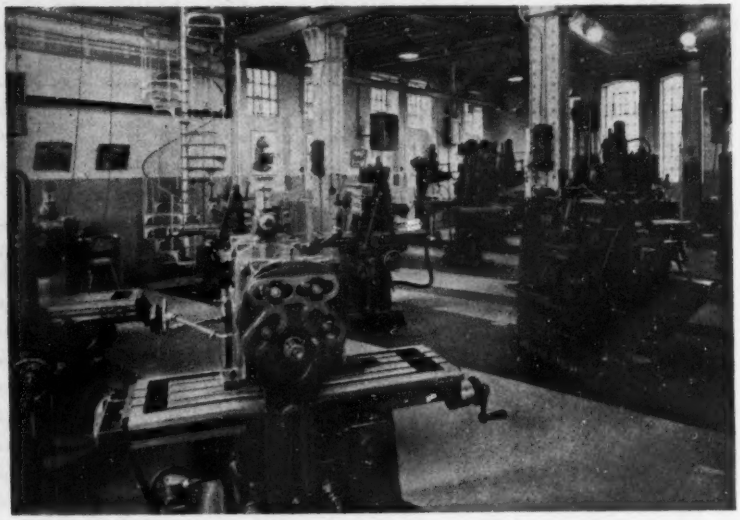
and Parts during January, 1958

Other Lathes		Milling Machines		Planing, Shaping and Slotting Machines		Presses and Sheet Metal-working Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
143 (11)	6,064	662 (20)	38,636	832 (6)	21,102	1,007 (19)	39,230	3,249(129)	144,781	467	53,530	10,808 (306)	499,540
59 (2)	1,526	—	—	—	—	278 (6)	4,973	10 (1)	227	61	4,129	408 (9)	10,855
—	—	605 (8)	30,153	—	—	— (1)	17	6 (1)	364	79	10,611	1,605 (25)	90,405
4 (1)	187	878 (12)	71,709	—	—	60 (3)	5,364	57 (5)	5,604	999	48,488	3,752 (104)	268,858
1 (1)	110	1,105 (3)	55,964	143 (1)	7,627	—	—	866 (14)	125,897	1,324	132,607	4,918 (37)	449,781
217 (2)	4,593	2,317 (40)	92,875	1,131 (4)	19,541	938 (21)	34,264	1,547 (29)	50,285	409	25,065	10,345(148)	343,136
424 (17)	12,480	5,567 (83)	289,337	2,106 (11)	48,270	2,283 (50)	83,848	5,735(179)	327,158	3,339	274,450	31,836(629)	1,662,575

Figures in parentheses denote number of machines. * Not including machine-tool cutting parts.

New Archdale Showroom

James Archdale & Co., Ltd., have recently opened a new showroom at their works in Ledsam Street, Birmingham, 16, principally for the display and demonstration of examples from their wide range of radial, vertical, and multi-spindle drilling machines, hydraulic feed drilling units, and twist drill grinding machines. A view in the showroom is shown in the accompanying illustration. Fully trained staff are in attendance to give advice on production problems, and customers and potential customers are invited to visit the premises at any time and see the equipment in operation.



A View in the New Showrooms of James Archdale & Co., Ltd.

Harper One-day Conference

Some 75 representatives of firms who are customers and suppliers of John Harper & Co., Ltd., and John Harper (Meehanite), Ltd., recently attended a one-day conference at the company's premises at Willenhall, Staffs. In a welcoming speech, Mr. W. H. Harper, managing director, mentioned that the company's castings and domestic hardware were exported to 53 countries, which included Scandinavia, Korea, Palestine, and the U.S.A.

Proceedings in the morning began with a talk entitled "Some Aspects of our Purchasing Situation," by the firm's purchasing agent, Mr. P. T. Appleby. Mr. John Harper, who has lately visited about 40 foundries and research organizations in the U.S.A., then spoke on industrial conditions in that country. In the American foundry industry, he said, the majority of firms were quite small and a jobbing foundry as large as that of his company was uncommon. The phosphorus content of the iron ore used was lower than of that available in Britain, and although this was beneficial from the standpoint of mechanical properties, the surface finish on American castings was not good unless they were subjected to additional treatments which resulted in increased costs. There were wide variations in the degrees of mechanization in American foundries, and sand slinger plants similar to that recently installed in the Harper foundry were quite commonly employed. Some large motor car plants had their own foundries, and the speaker had been told that after cylinder blocks were cast in one foundry, they were passed through the subsequent production processes so rapidly that they were still warm from the casting operation when they were assembled in the finished engine.

A talk on "Industrial Design" was then given by Mr. D. H. Middleton, development manager, and, finally, Mr. J. W. Dews, chief metallurgist, discussed the history of the development of high-duty cast irons.

Subsequently, visitors had the opportunity of touring the works. In addition to the production of a wide variety of sand castings, parts such as the sheet-metal panels for the company's oil-burning space heaters are made in a press shop, where Taylor & Challen and Hordern, Mason & Edwards, presses were noted. On one press (a No. 24 Taylor & Challen), a Meehanite punch and die were being used for making 9-in. diameter by 5-in. deep tanks for oil heaters. The parts were produced in one operation from 24-gauge mild steel sheet, and it was stated that the tool had already produced 45,000 tanks without requiring attention.

Machine Tool Slide Problems

(*Continued from page* 1191)

that it is to be applied for a similar purpose on a gear broaching machine which is being built on the Continent. In the paper, reference is made to oil flotation of the column of a heavy horizontal boring machine, and it is stated that this method of support appears to be satisfactory where the weight of the moving part is large in relation to the cutting forces. For other applications, an arrangement of pressure balanced bearings offers considerable promise. Such a system has been adopted for the Fairey 3-dimensional milling machine which was recently described in MACHINERY, and investigations are being carried out at Manchester College with a guide of cylindrical form, supported over its full length, in conjunction with a flat surface. It is pointed out, however, that it is not easy to produce an accurate cylinder of considerable length, which is slotted for support purposes. With pressure balanced guides the oil film "stiffness" and the volume of flow required depend on clearances, and a compromise must be sought between accuracy, which is reflected in machine building costs, and oil flow which determines the sizes of tanks, pumps, filters, and coolers required.

To permit the necessary steady and accurate movement of a slide, particularly during reversal, two backlash-free transmission designs have been proposed. With one arrangement, the force required would be provided by a hydraulic cylinder and piston, and a screw would control the accuracy of movement. The load on the screw would be kept at a constant low value, by means of a strain gauge acting through a transducer. With the other drive system a worm and rack would be employed in conjunction with a short stroke hydraulic cylinder which would provide for accurate positioning.

There is no doubt that research in this field is of vital importance to enable new conceptions of machine performance to be realized in the near future.

Jones & Shipman Exhibition

A. A. Jones & Shipman, Ltd., Narborough Road South, Leicester, inform us that they will hold an exhibition of precision grinding machines and engineers' small tools at the Blantyre works (Blantyre Industrial Estate, near Hamilton, Lanark) of Turner Brothers (Birmingham), Ltd., from June 2 to 7, to which engineers and students are invited. A number of machines will be set up to show examples of production and toolroom work, including external, internal, tool, cutter, and surface, grinding operations. In addition, demonstrations will be given of circular form tool grinding, in conjunction with optical measuring equipment; form grinding with crush-dressed wheels; automatic gauge sizing; and cylindrical grinding to a surface finish of one micro-inch and less.

The cylindrical grinders on show will include the type 520 instrument makers' machine, and the type 1030, 7- by 24-in. capacity machine, which is arranged for fully-automatic operation and incorporates automatic gauge sizing equipment. A number of universal external and internal grinding machines, with double-swivelling back-slides for grinding steep tapers, will also be displayed. Among other machines to be exhibited may be noted the type 540 APD hydraulic surface grinder, with the new head-mounted Diaform dressing attachment; the type 1012 27- by 10-in. surface grinder, with crush-forming equipment; the type 310 tool and cutter grinder; and a 4-wheel machine for grinding and lapping cemented carbide. For circular form-tool grinding, there will be a type 1215 machine, which incorporates a Diaform pantograph-controlled wheel forming attachment, and high-magnification optical projection equipment.

A separate section of the exhibition will be devoted to the range of J. & S. engineers' small tools, and a selection of engineers' instruments and auxiliary equipment.

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23/5/58

Industrial Notes

CRAVEN BROS (MANCHESTER), LTD.—The address of the London office of this company is now Bridge House, 181 Queen Victoria Street, E.C.4 (telephone number, City 2902).

INSTRUMENTS (HUDDERSFIELD), LTD., Prospect Street Works, Huddersfield, inform us that the title of the company is being changed to Sanderson Instruments (Huddersfield), Ltd. The firm make and repair all types of vernier gauges and undertake other precision engineering work.

THE NEXT FACTORY EQUIPMENT EXHIBITION, which is to be extended from six to ten days, will be held at Earls Court, London, from April 7 to 17, 1959, and the scope will be widened to include methods and materials for reducing noise in factories and offices.

METALECTRIC FURNACES, LTD., Cornwall Road, Smethwick, announce that they have received an order from Norway for a continuous electric furnace for stress-relieving silicon-steel transformer laminations. The furnace, which will be rated at 200 kW, will have an output of 850 lb. per hour, and is the second to be ordered from Norway within the past 12 months.

THE WADKIN MAGAZINE for April, published by Wadkin, Ltd., Green Lane Works, Leicester, is largely devoted to a pictorial survey of events in the career of the late Sir Holland Goddard. Tributes are included from his co-directors and from subsidiary companies, also extracts from some of the hundreds of tributes received from his friends and associates throughout the world.

SWAN, HUNTER & WIGHAM RICHARDSON, LTD., Wallsend, Northumberland, announce that they are to co-operate with the Nuclear Power Plant Co., Ltd., Booths Hall, Knutsford, Cheshire, in the design and building of ships powered by nuclear energy. The Nuclear Power Plant Co., Ltd., is also associated with the construction of a large factory at Newburn-on-Tyne for the manufacture of graphite for use in atomic power plants.

HEENAN & FROUDE, LTD., Worcester, have received an order from B.T.R. Industries, Ltd., Burton-on-Trent, for a special V-belt test plant. Drive will be taken from a 15-h.p. Heenan electric dynamometer, and the power will be transmitted, by the V-belts undergoing test, to a Froude hydraulic dynamometer. Provision will be made for applying known tensions to the belts by means of weights, and for measuring and taking up belt stretch.

SHIPBUILDING ORDERS.—In the first quarter of the year, orders for 39 new ships of 41,000 tons were placed with British shipyards, compared with 180,000 tons in the previous quarter, and 600,000 tons in the first quarter of 1957. Cancellations in the three months, at 183,000 tons, were nearly double those for the whole of last year. The value of orders held by British shipbuilders at the end of March had dropped by £100,000,000 to £900,000,000.

W. E. NORTON (MACHINE TOOLS), LTD., Grosvenor Gardens House, Grosvenor Gardens, London, S.W.1, in conjunction with Bronx Engineering Co., Ltd., will show a 20-minute film on June 11, at 6.30 p.m. This film is devoted to Bronx press brakes, and examples of operations and tooling from recent applications.

Tickets may be obtained from the Company, and the film will be shown at the Royal Empire Hall, Craven Street (Northumberland Avenue), London, W.C.2.

RADIO HEATERS, LTD., Eastheath Avenue, Wokingham, Berks., will hold an exhibition of their products at The Engineering Centre, Stephenson Place, Birmingham, 2, from June 2 to 6. The exhibits will include induction heaters for hardening, brazing, and soldering operations, a vertical shaft-hardening machine, plastics sheet welding equipment, and dielectric heaters. A film entitled "RF Heating in Industry" will be shown throughout the period of the exhibition.

LOCKHEED TO DEVELOP NUCLEAR INDUSTRIAL POWER.—Lockheed Aircraft Corporation have formed a new branch to develop the industrial use of nuclear energy. The design and manufacture of nuclear reactors for industry will be undertaken, and the company will develop, install and service these reactors.

Preliminary studies for "a family of reactors for supplying industrial heat, which is competitive with present-day gas, coal or oil fuels" have been completed. The company will also design and build specific research and training reactors for universities, and will specialize in the field of small, transportable, packaged power units.

AUCTION SALES.—There will be a sale of machine tools, cranes, and miscellaneous stores from M.O.S. Sub-Depot, Lily Lane, Byley, Middlewich, Cheshire, on June 3 and 4, at New Islington Public Hall, Ancoats, Manchester. The auctioneers will be J. H. Norris & Son (Dept. N), 9 Albert Square, Manchester, 2, and items will include Holbrooke, Bradford, Denham, Smart & Brown, and other centre and capstan lathes, a universal grinder, vertical and thread millers, radial and pillar drills, and horizontal and vertical presses.

Vehicles, machine tools, and miscellaneous stores, from M.O.S. Storage Depot, Royal Arsenal, Woolwich, London, S.E.18, will be sold on June 9 to 12 by Fuller, Horsey, Sons & Cassell (Dept. N), 10 Lloyd's Avenue, London, E.C.3. Machine tools and miscellaneous stores, from M.O.S. Storage Depot, Ruddington, Notts., will be sold on June 17 and 18 by Walker, Walton & Hanson (Dept. N), Byard Lane, Bridlesmith Gate, Nottingham.

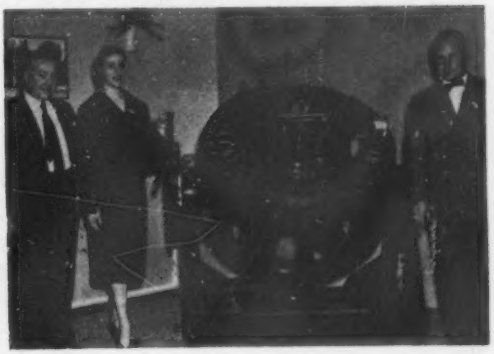
G.T.M.A. Export Catalogue

The fourth edition of the export catalogue of The Gauge and Tool Makers' Association, Standbrook House, 2-5 Old Bond Street, London, W.1, has recently been issued. An opening section, concerned with the aims, objects and exports of the Association is printed in English, French, and Spanish, as is the index to members' products, and many of the individual announcements are also trilingual.

Following the products index, there is an alphabetical list of members of the Association, also of the British Power Press Manufacturers' Association. Companies' announcements, which occupy the greater portion of the catalogue, are well presented and illustrated.

Some Exhibitors at the Gauge and Tool Exhibition (*continued from page* 1236)

MR. H. A. HOBROW (Kemworthy Jig & Press Tool Co., Ltd.) (right)



Mr. G. SMITH, MRS. A. LESLIE and MR. A. E. LEEDHAM (Belsize Engineering Co., Ltd.)

MR. H. KILLINGLEY and MR. W. D. HUDSON (Essex Tool & Gauge Co., Ltd.), and MR. S. C. EAST (*Machinery*)

MRS. E. RUBERT, MR. M. P. RUBERT and MRS. A. TAYLOR (Rubert & Co., Ltd.)

MR. L. BIRCH and MR. I. H. HOUSTON (Aldridge Tool & Engineering Co., Ltd.), and Mr. L. W. WARNER (Ratcliffe Tool Co., Ltd.)

MR. R. E. GREEN (*Machinery*), MR. F. J. COX (Frank J. Cox Sales, Toronto), MR. M. PRYCE (George Taylor & Son, Ltd.), MR. J. R. DENNIS (Qualcast (Cuffins), Ltd.), and MR. W. E. NORTON W. E. Norton (Machine Tools Ltd.

Personal

MR. GEORGE W. DAY, who, for 30 years, has been a works and sales representative in the Midlands area for A. A. Jones & Shipman, Ltd., has joined Notsa Engineering Co., Ltd., Aston-on-Trent, Derby, as technical director.

MR. FRED HAIGH has been appointed personal assistant to Mr. B. B. Green, a director and general sales manager of Edgar Allen & Co., Ltd., Imperial Steel Works, Sheffield, 9, and MR. IRVING SOMERFIELD has been appointed home sales manager (Steel, Engineers' Tool, Magnet and Saw Departments).

MR. E. E. PHEASEY, M.B.E., M.I.B.E., who was formerly with Foster, Yates & Thom, Ltd., Blackburn, Lancs., has been appointed works director of Thompson Bros. (Bilston), Ltd., Bradley Engineering Works, Bilston, Staffs.

MR. R. J. PETTITT, of 2 Sancroft Road, Harrow Weald, Harrow, Middlesex, will in future cover the county of Essex and London postal districts N., E., and E.C., for B.E.N. Patents, Ltd., High Wycombe, Bucks. MR. A. H. STENNING, of 5 Woodville Gardens, Ealing, W.5, will cover the county of Middlesex and London postal districts W., N.W., and S.W. (north of the Thames).

Machine Tool Share Market

A generally firm undertone was maintained in stock markets during the past week, but extremely quiet conditions prevailed in most sections, and buying interest was selective.

The gilt-edged market pursued a steady course, and, on balance, moderate gains were recorded among British Funds and other high-grade fixed interest stocks.

Activity in connection with commercial and industrial shares remained at a low level, and prices showed some irregularity, but the majority of changes were to slightly higher levels, and a few good features developed.

Machine tool issues were steady to firm. Arnott & Harrison advanced 3d. to 14s.; Clarkson (Engineers), 3d. to 12s. 6d.; John Shaw & Sons (Wolverhampton), 3d. to 11s. 9d.; Chas. Churchill, 1½d. to 4s. 6d.; Geo. Cohen, 4½d. to 11s. 10½d.; and Noble & Lund, 6d. to 6s. On the other hand, Craven Bros. (Manchester) lost 3d. at 6s. 9d.; John Harper, 3d. at 13s. 9d.; and Thos. W. Ward, 7½d. at 73s. 9d.

SHEFFIELD TWIST DRILL & STEEL CO., LTD. Final dividend 50 per cent, making, with the interim, a total distribution of 66⅔ per cent (same).

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	7/10½
Allen (Edgar) & Co., Ltd.	Ord.	£1	27/6
" "	5% Prf.	£1	14/9*
Arnott & Harrison, Ltd.	Ord.	4/-	14/-
Asquith Machine Tools Corp., Ltd.	Ord.	5/-	10/1½
" " "	6% Cum. Prf.	£1	18/6
Birmingham Small Arms Co., Ltd.	Ord.	£1	28/6
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum. "B" Prf.	£1	17/9
" " "	4% 1st Mort. Deb.	Stk.	85/-
British Oxygen Co., Ltd.	Ord.	£1	32/6
" " "	6½% Cum. Prf.	£1	21/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/7½xd
Broom & Wade, Ltd.	Ord.	5/-	10/4½
" "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	14/9xd
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	18/6
Butler Machine Tool Co., Ltd.	Ord.	5/-	6/-
" "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/6
" " "	6% Cum. Prf.	£1	26/3
Churchill Machine Tool Co., Ltd.	Ord.	5/-	18/7½
" " "	6% Cum. Prf.	£1	18/6
Clarkson (Engrs.), Ltd.	Ord.	5/-	12/6
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/10½
" " " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	13/3
" " " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/9
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/9
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" "	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/6
Greenwood & Batley, Ltd.	Ord.	£1	46/10½
Harper (John) & Co., Ltd.	Ord.	5/-	13/9
" "	4½% Red. Cum Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	67/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/3
" " "	"B" Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	44/6xd
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/3xd
Kitchen & Wade, Ltd.	Ord.	4/-	10/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	7/9
Modern Engineering Machine Tools, Ltd.	Ord.	5/-	9/6
Newall Engineering Co., Ltd.	Ord.	2/-	4/6
Newman Industries, Ltd.	Ord.	2/-	2/3xd
" " "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	6/-
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	16/6
" " "	5½% Cum. Prf.	£1	25/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	21/3xd
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	33/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	11/9
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	35/-
" " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	6/3xd
Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/9xd
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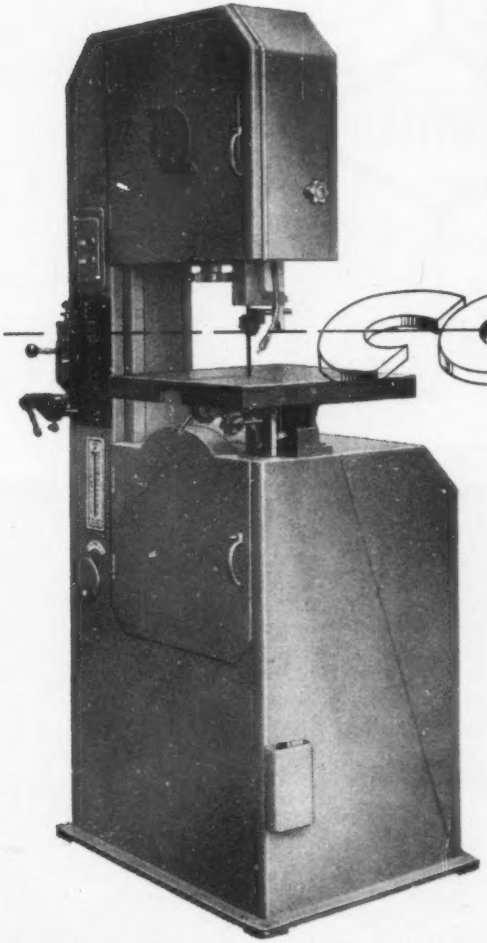

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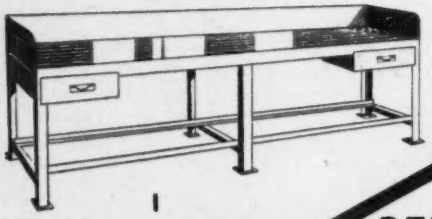

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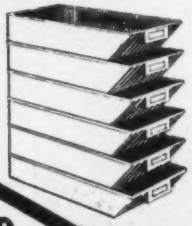

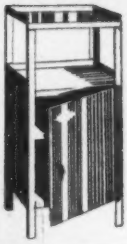

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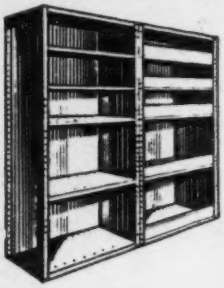

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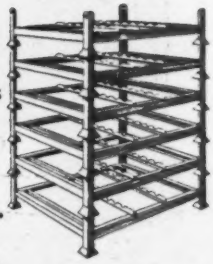

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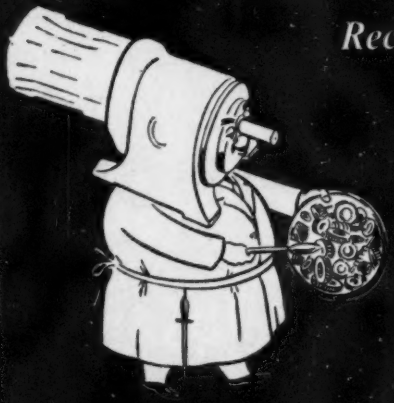

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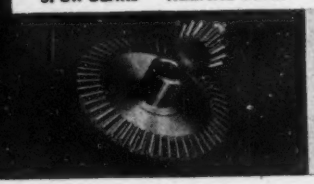

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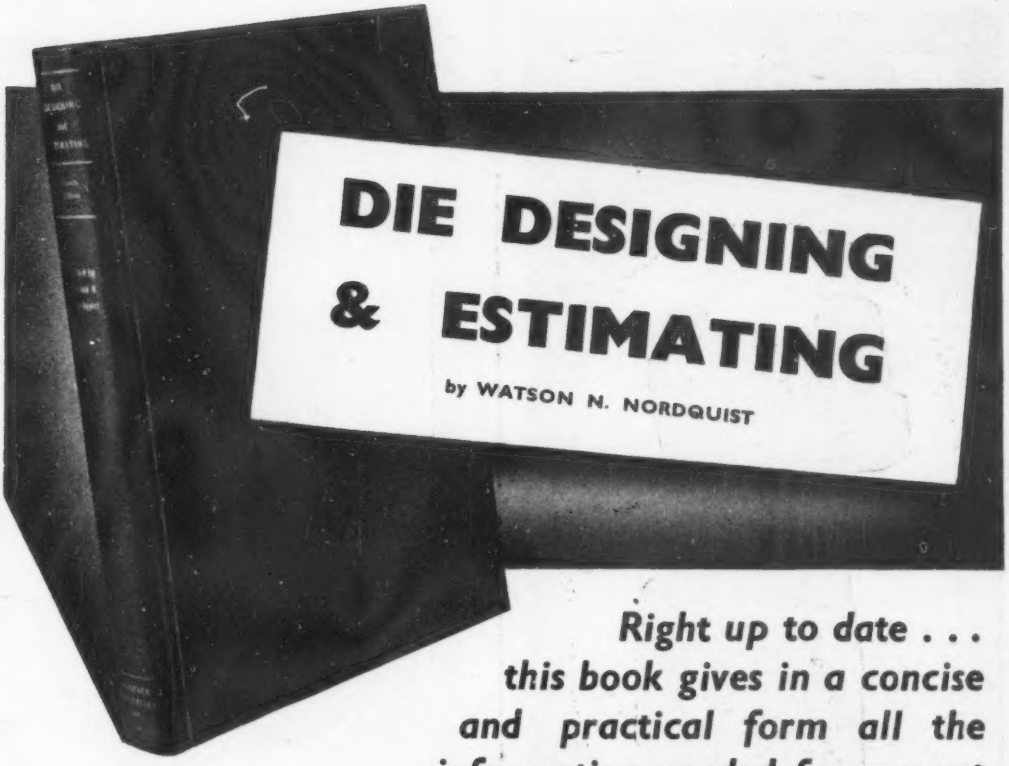

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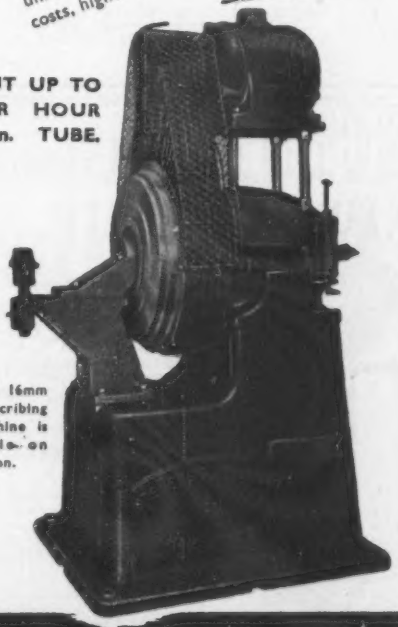

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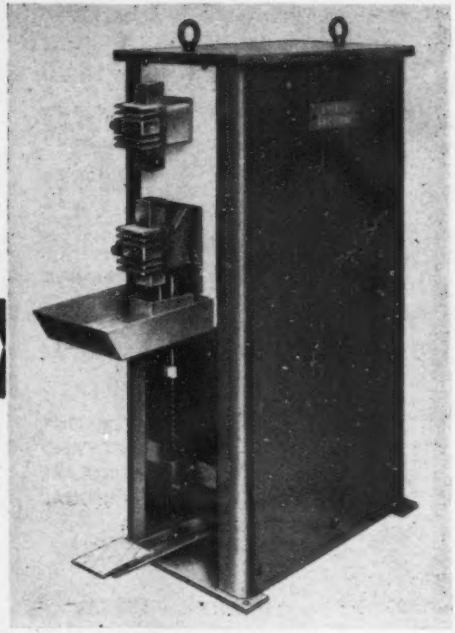

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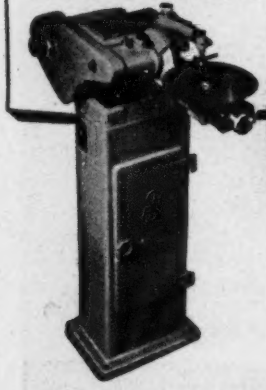

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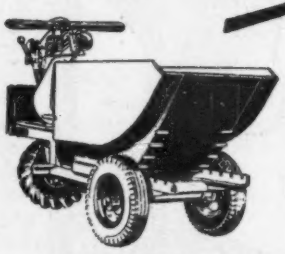

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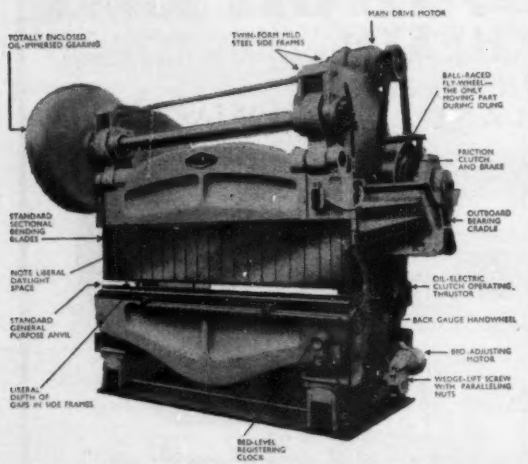
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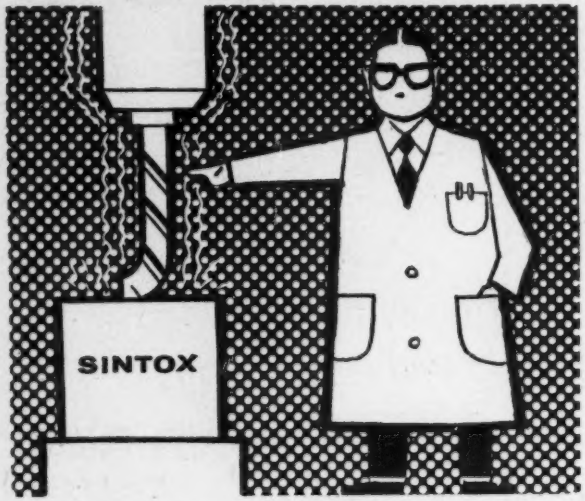

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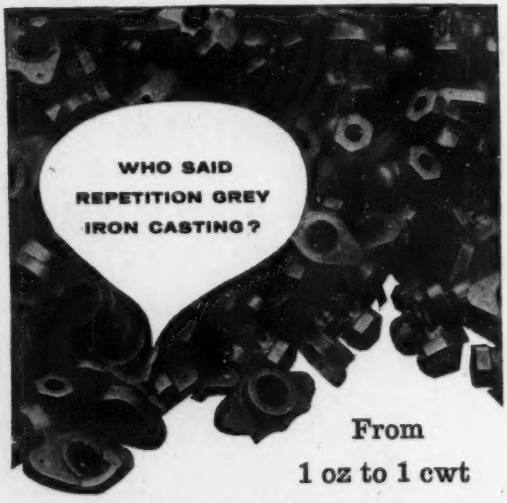

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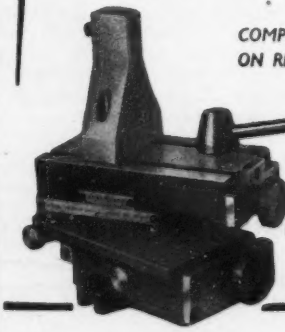

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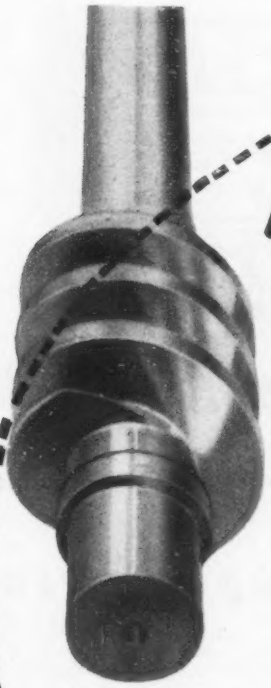

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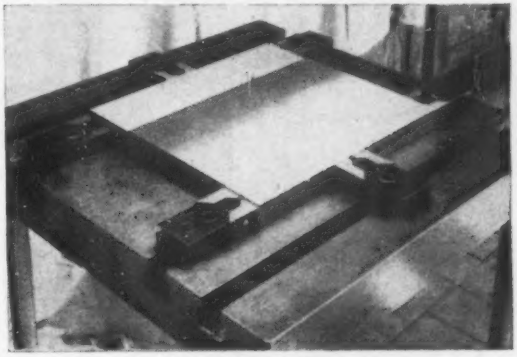

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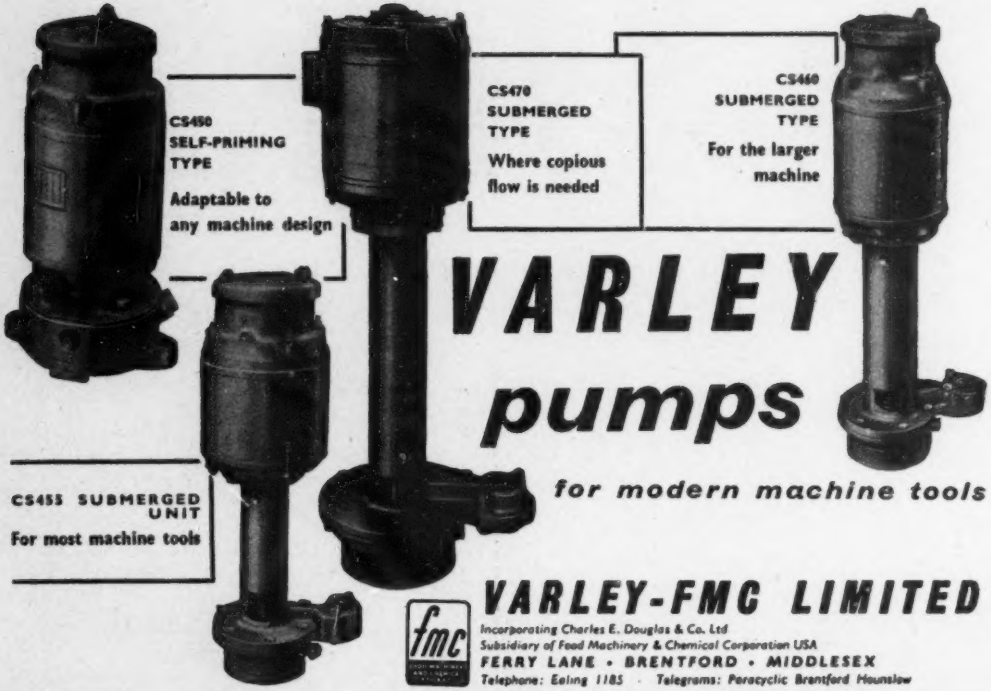

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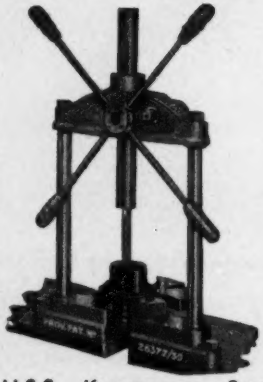

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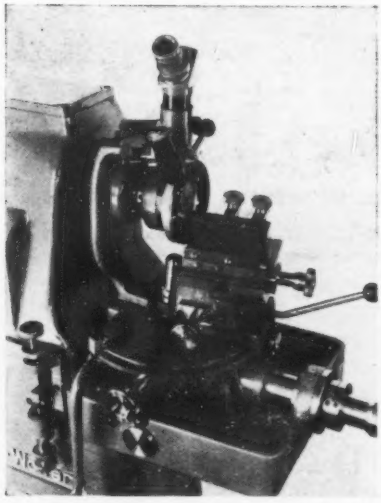

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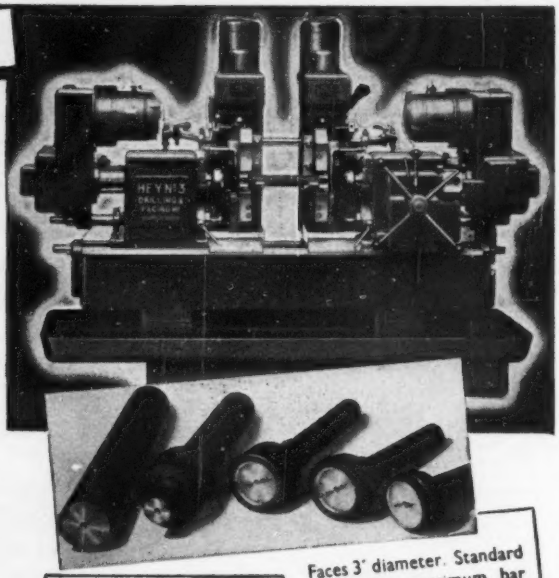

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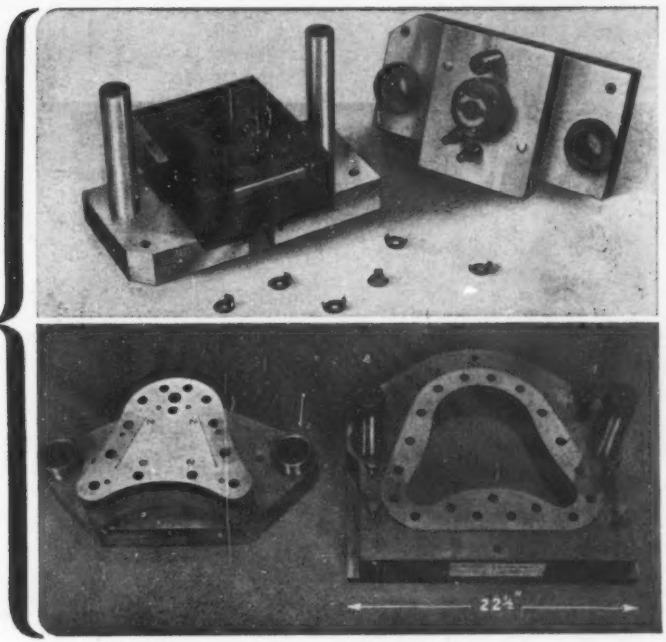

BECAUSE of its high chromium and carbon content, 476 Steel resists wear and is specially suited for exacting punching and forming operations on abrasive materials. It has also considerable toughness, the tool edges standing up to shock applications, such as heavy punching and shearing. The photographs illustrate two contrasting applications. (Top) Three stage press tool for punching and forming clamping washers from brass strip (courtesy, Clarke Chapman & Co. Ltd.). (Bottom) Heavy press tool for blanking hoist bracket in ⅛" thick mild steel (courtesy, Stothert & Pitt Ltd.). 476 is air hardening and machinable in the annealed condition. Applications include blanking dies and punches for sheet brass, copper, zinc, high silicon transformer steels and hard abrasive materials generally; blanking tools for steel sheet and plate; blades for flying strip shears and plate shears; deep drawing dies, cupping dies, forming dies; sheet metal forming rolls; circular cutters for strip; trimmer dies, thread rolling dies; gauges and other precision tools; taps, staybolt taps; brick mould liners; master hobs for cold hobbing plastic moulds; cut moulds for plastics.

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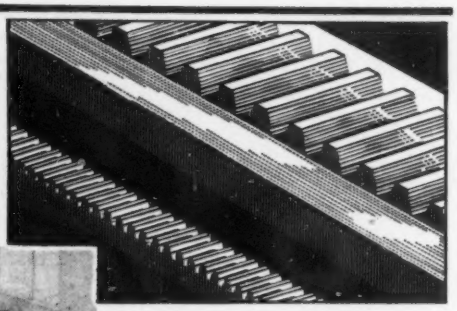

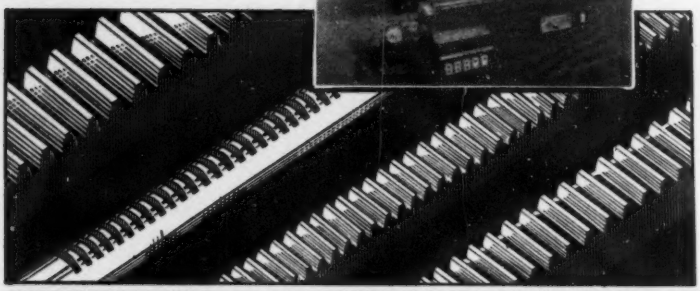

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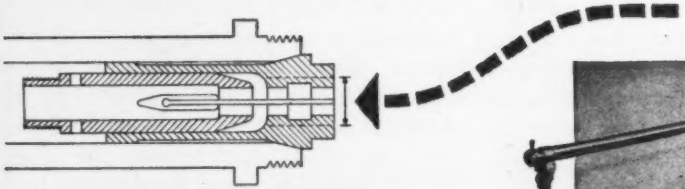

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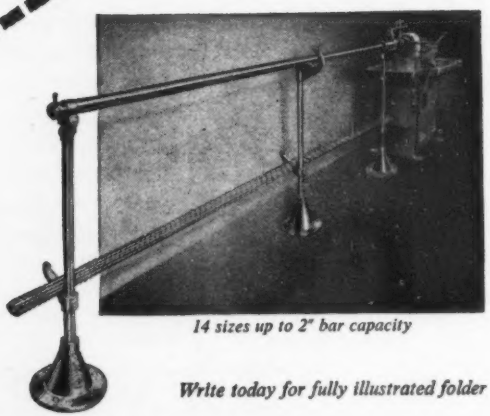

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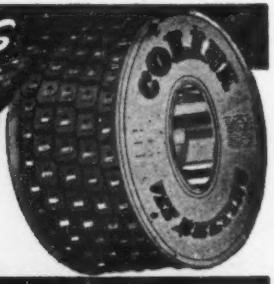

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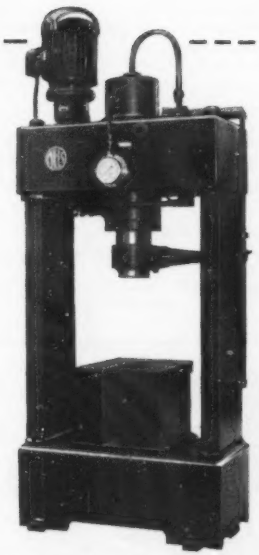

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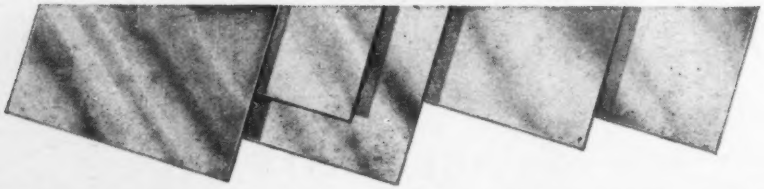

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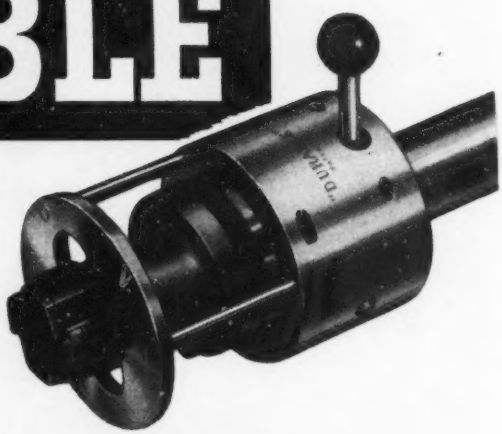

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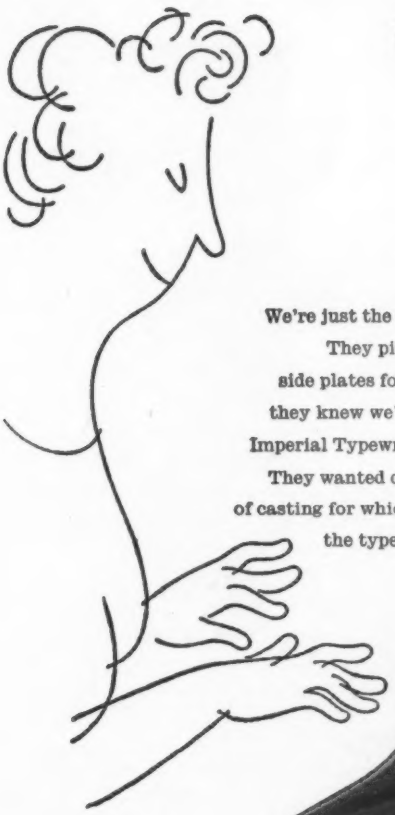

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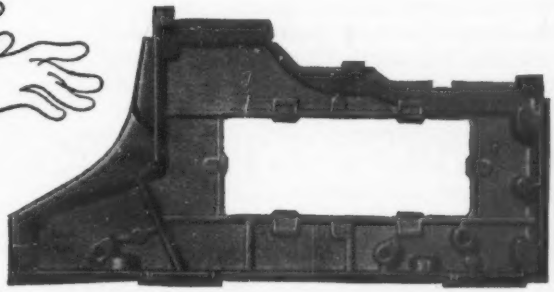

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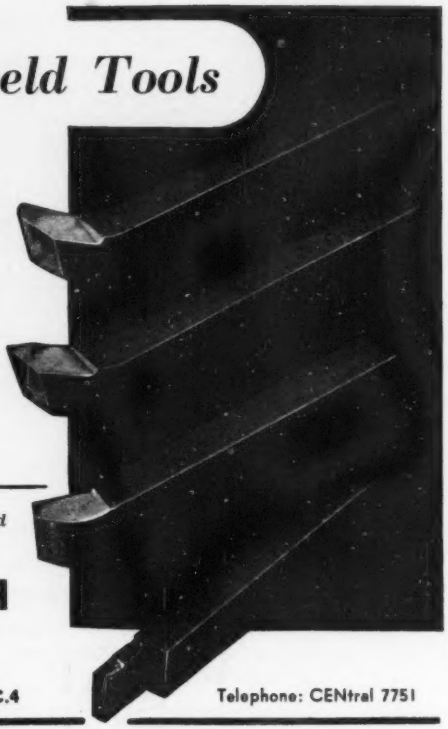

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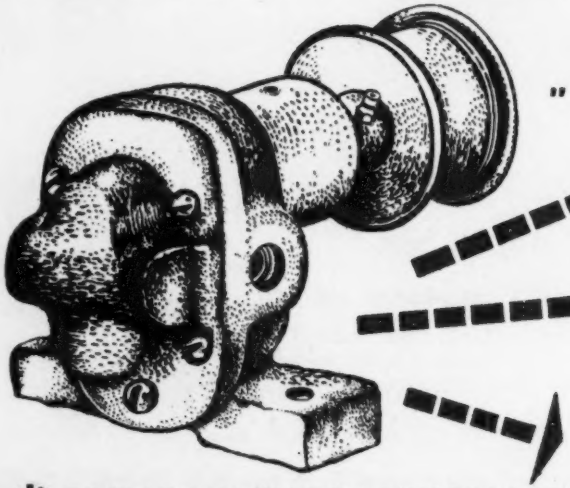

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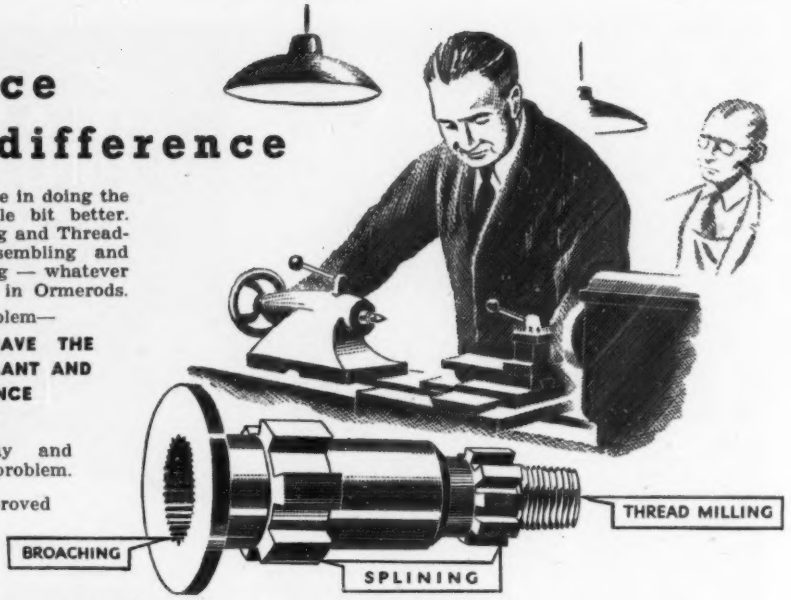

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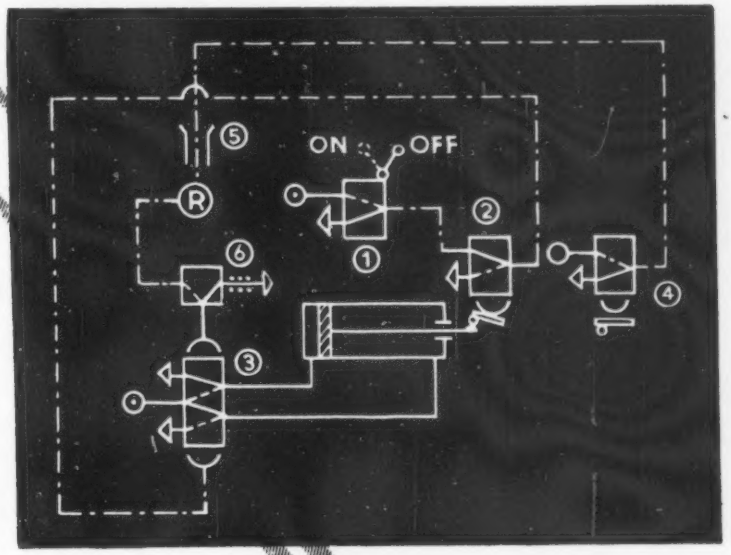

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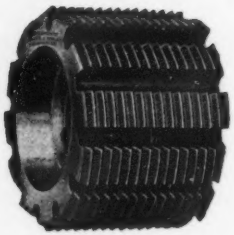

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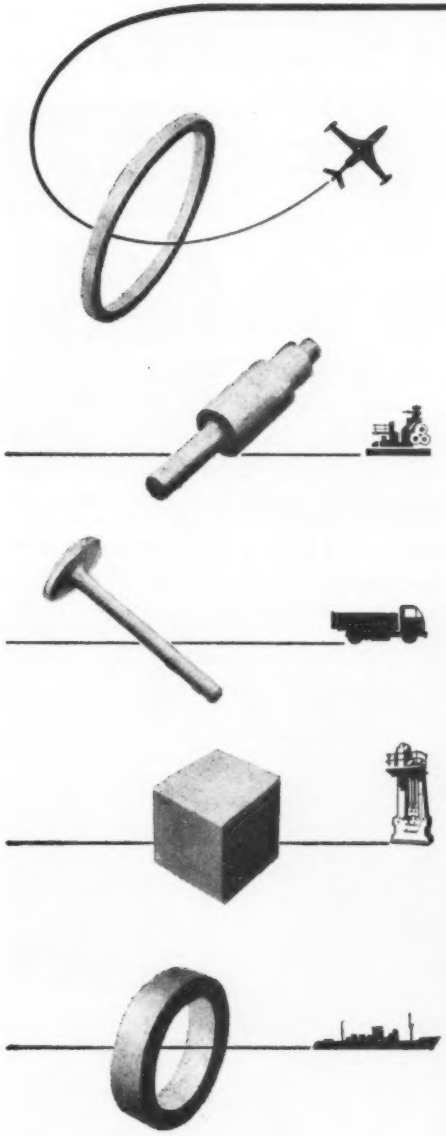

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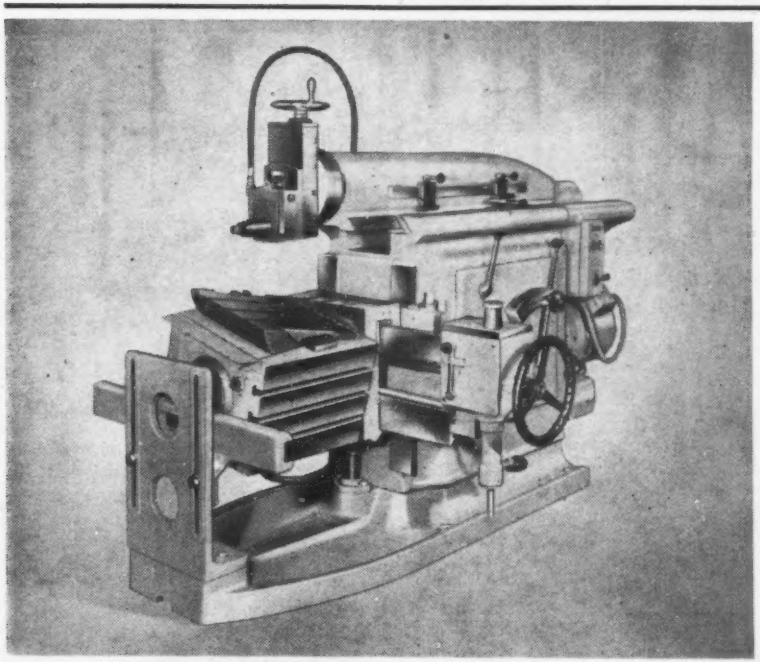

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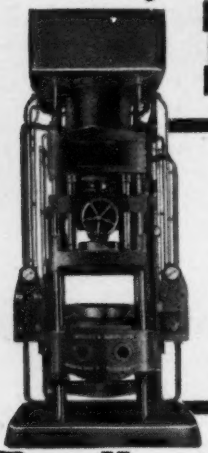

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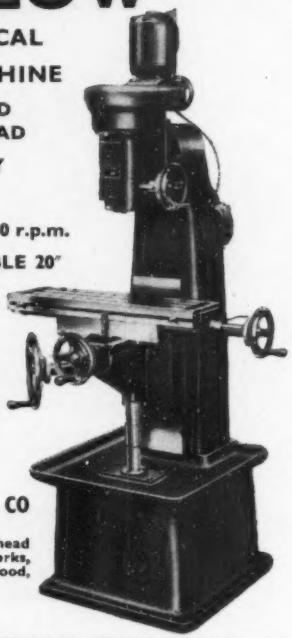

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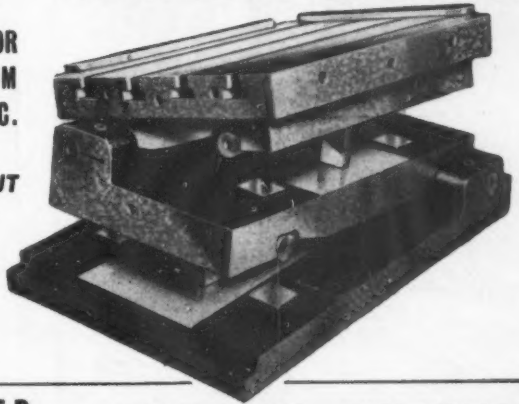

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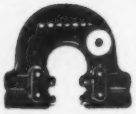

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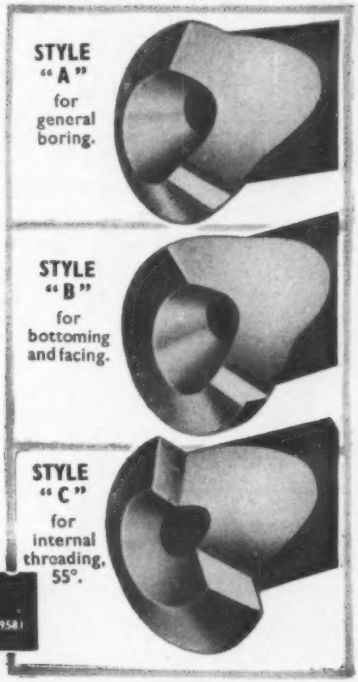

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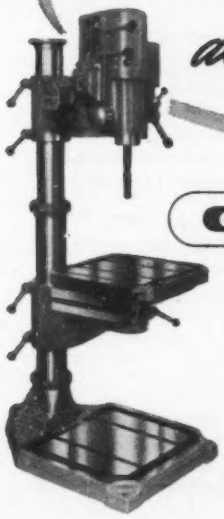

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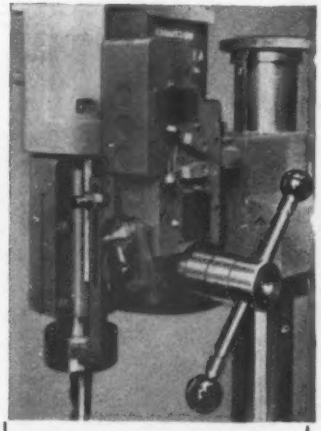

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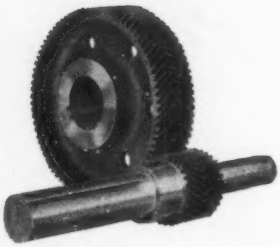

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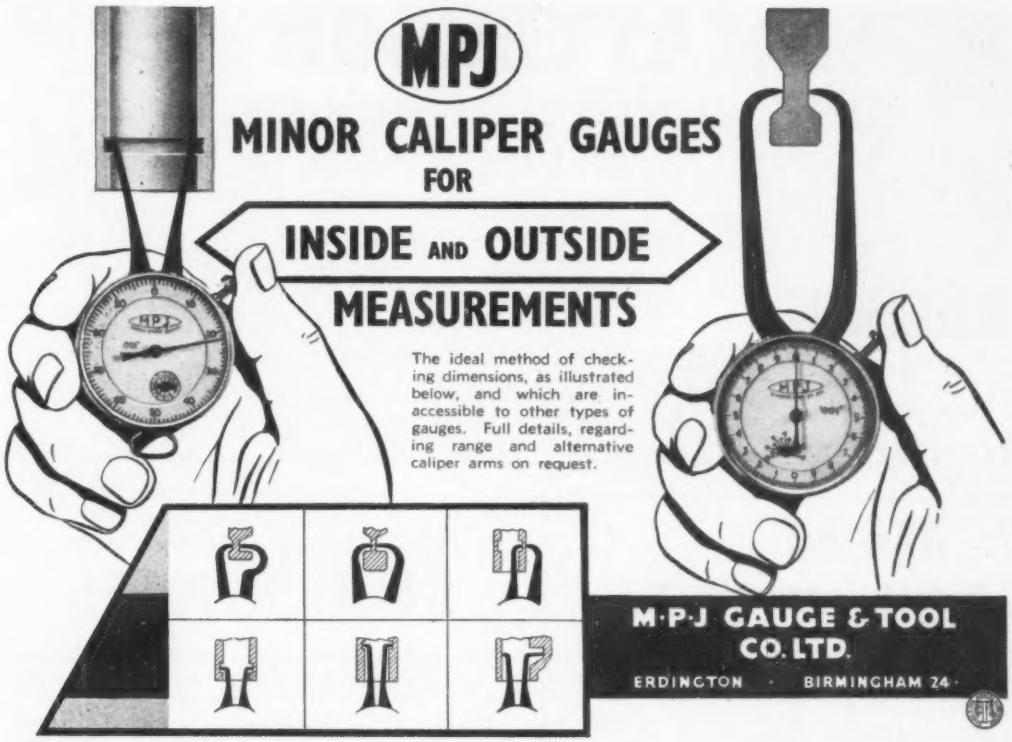

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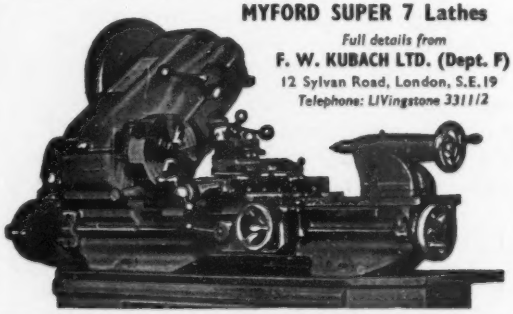

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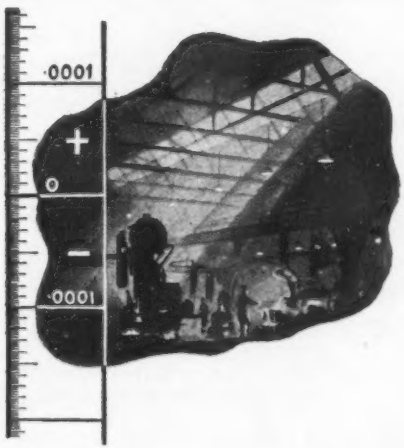

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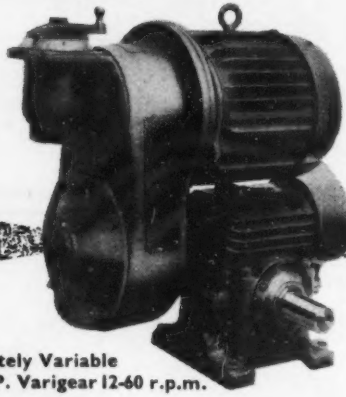

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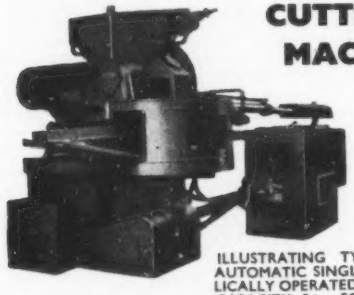

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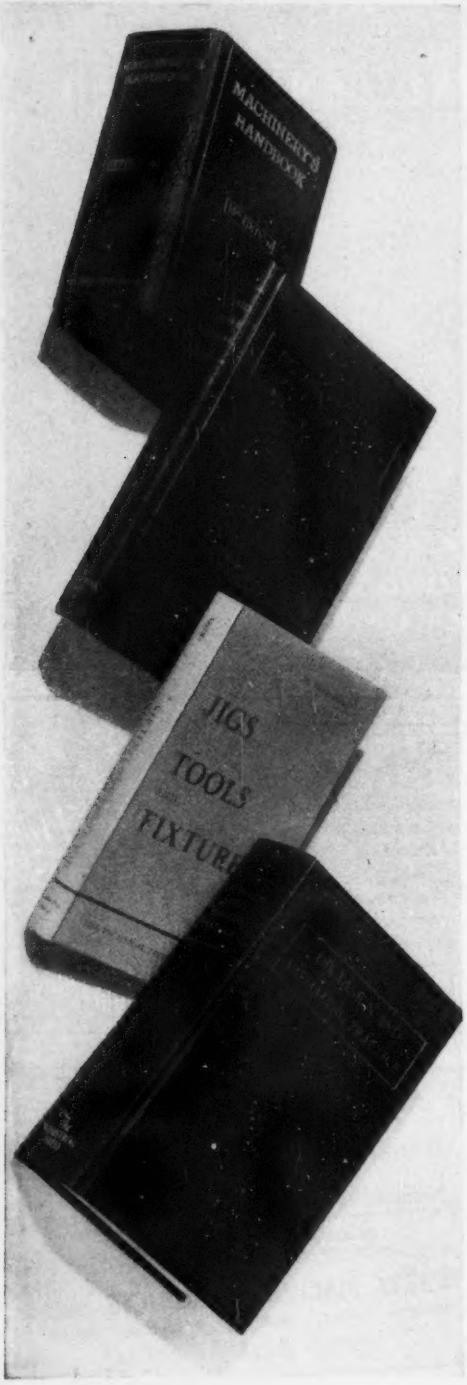

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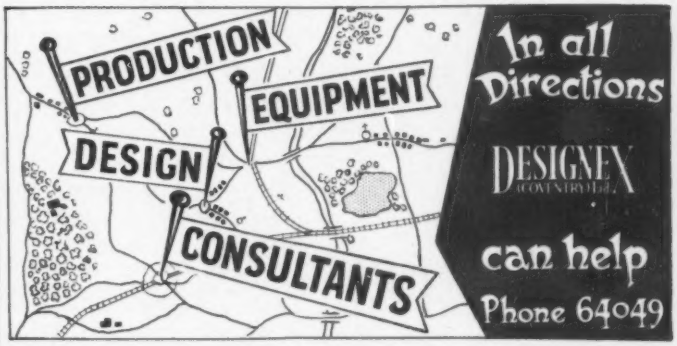

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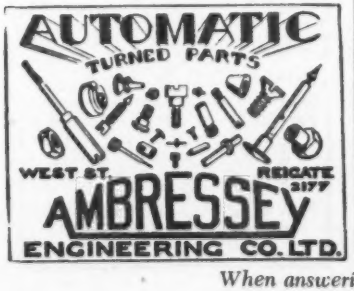

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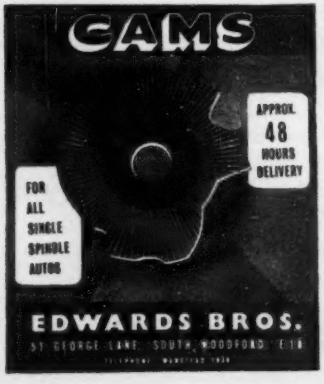

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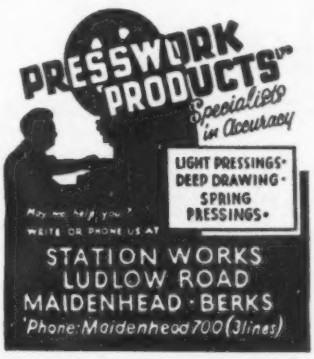

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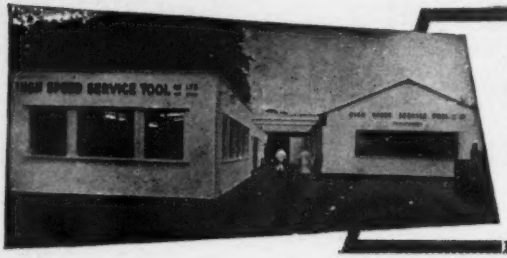

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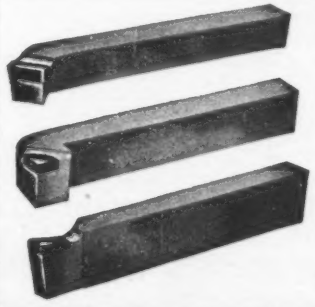

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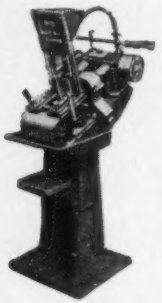

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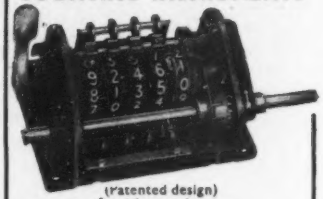

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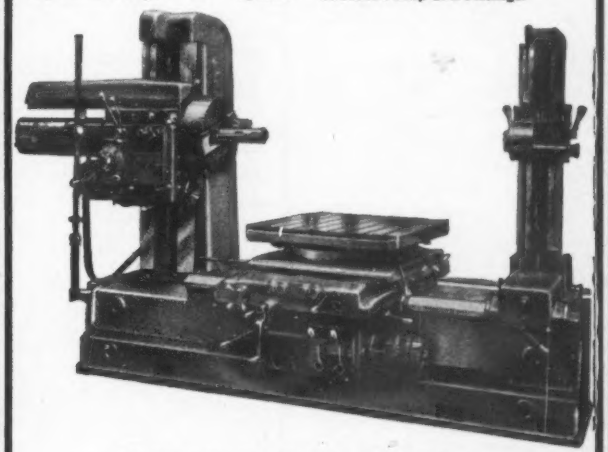

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NORTON 6in. by 18in. Surface Grinder.
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F.L.C.B. 17in. by 10ft. S.S. & S.C. Lathe. Speed range 1.08-152 r p.m.
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TOWN 4ft. No. 3 M.T. Radial Drill. Speed range 20-1,000 r.p.m.
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ASQUITH Type E.G.C. 6ft. Girder Type Radial Drill. Speed range 183-580 r.p.m.
ASQUITH Type E.G.C. 8ft. Girder Type Radial Drill. Speed range 31-830 r.p.m.
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CHURCHILL 10in. by 36in. Hydraulic Plain Cylindrical Grinding Machine.

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CUTTAT HYPERMIL Production Milling Machine, 43in. by 10in. working surface of table, with 4 automatic cycles to table.

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MILWAUKEE No. 2H Vertical Milling Machine, table 50in. by 10in.
REED PRENTICE No. 6 Vertical Milling Machine, table 84in. by 20in.
SUNDSTRAND Hydro-Screw Rigidmill Automatic Production Milling Machine, table 7in. by 14in., table traverse 48in.
CINCINNATI 1/12 Horizontal Production Milling Machine.
RICHMOND Model 03.SD Universal Milling Machine with Dividing Head, Vertical Attachment, etc.
CENTEC Model 3R Automatic Production Milling Machine, table 8in. by 30in.
CINCINNATI 2M Universal Milling Machine.
MILWAUKEE No. 4H Plain Horizontal Milling Machine, table 74in. by 15½in.
CINCINNATI No. 3 Dial Type Plain Horizontal Milling Machine, table 62½in. by 15in.
VICTOMATIC Automatic Cycle Production Milling Machine, capacity 50in. by 10in.
REED-PRENTICE No. 5 Vertical Milling Machine, table 68in. by 16in.

GEAR MACHINES

MUIR 72in. spur and helical Gear Generating Machine.
ORCUTT 24in. Gear Grinding Machine.
KOLB Gear Grinding Machines.
SYKES V.10 Gear Generator.
GLEASON 3in. Bevel Gear Generators. (Two available.)
GLEASON No. 9 Bevel Gear Completor Machine.

DRILLING MACHINES

KITCHEN & WADE 28V10 Single Spindle Vertical Drilling Machine, No. 4 M.T.
ARCHDALE Multi-spindle Drill Machine, 36 spindles.
HETTNER Radial Drilling Machine, having 10ft. Radial Arm elevating column type.
TOWN 30in. Vertical Spindle Boring, Drilling and Tapping Machine, No. 5 M.T.
KITCHEN & WADE 4ft. 6in. Radial Drilling Machine.
KITCHEN & WADE 4ft. Radial Drilling Machine.
ASQUITH OD1 6ft. Radial Drilling Machine.

CAPSTAN & CENTRE LATHES

WARD 7B Hexagon Turret Lathes with bar feed. (Two available.)
OLDFIELD & SCHOFIELD Boring and Surfacing Lathe, cross-traversing Turret type.
LE BLOND Regal Centre Lathe, 9¼in. by 42in. between centres.
BRADFORD 8¼in. centre height by 30in. between centres Centre Lathe.
HERBERT No. 8 Combination Turret Lathe.
URQUHART LINDSAY & ROBERTSON ORCHAR Centre Lathe, 16in. by 30ft. 6in. between centres.
LIBBY Model 2H-8 Combination Turret Lathe, 8¼in. hollow spindle.
HERBERT No. 12 Combination Turret Lathe with comprehensive tooling.
NILES Centre Lathes 13¼in. centre height by 27ft. between centres. (Two available.)
NILES Centre Lathes, 15in. centre height by 28ft. between centres. (Two available.)
BETTS-BRIDGEFORD Centre Lathe, 15in. centre height by 16ft. between centres. (Two available.)
WARD No. 7 Combination Turret Lathe.

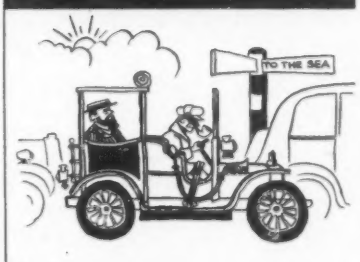
AUTOMATICS

ACME GRIDLEY Model RA6 2¼in. spindle Bar Automatic.
PONGRACZ Single Spindle Automatic capacity 10 mm.
CONOMATICS 3¼in. 4-spindle Bar Automatics. (Three available.)

PLANING MACHINE

URQUHART LINDSAY & ROBERTSON ORCHAR Spiral Drive Heavy Duty Planing Machine, capacity 16ft. by 5ft. by 5ft.

Newman for MACHINE TOOLS



Topical Touch

Some of these holiday traffic jams do last a long time*

***Try Newman for strictly up-to-date Machine Tools powered by new-fangled electricity**

All the machines on this page are motorised for 400-440 volts, 3-phase, 50 cycles.
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Telephone : CLErkenwell 6481

ALL MACHINES MOTORISED FOR 3 PHASE SUPPLY UNLESS OTHERWISE STATED

AUTOMATICS
CONOMATIC ⅝ 4 Spindle.
INDEX OR/12. ½in. capacity.
CLEVELAND 1¼in. by 18in. Model B.
CAPSTANS
WARD No. 8 Combination. Serial R.
TURNER 1½ A.
WARD 2A, Serial WT and 3A Serial M.
GISHOLT No. 4 Simplified. 2in. cap.
DRUMMOND Model K, 1¼in. Bar feed.
HILLE R.H. 15½in. Bar feed.
ACCURATOOL ⅝in. Bar feed.
WARNER & SWASEY No. 2 1in. Bar feed.
HERBERT No. 7 Combination Turret.
ACME 5W Universal Turret, 2in. bar feed.
LIBBY 4A 2in. bar feed.
MURAD ⅝in. bar feed.
HAHN & KOLB RH25. 1in. bar. Unused.
SOUTHWARK No. 2. 1½in. bar feed.
DRILLS
JONES & SHIPMAN 2-sp., 15in., No. 2 M.T.
HERBERT Type V 2 spindle.
GRIMSTON Electriska.
DENBIGH 21in. B.G. New.
JONES & SHIPMAN 15in. Speed Drill-Max.
HERBERT Type H Junior Pillar.
CORONA 12AX ⅞in. cap.
BOLEY Cluster Type.
BRISDON ⅝in. 2 Spindle.
ARCHDALE 20in. Mfg.
15in. HERBERT Type C, No. 3 M.T.
ENGRAVERS
T.M.A. Type G.3
LIENHARD New. All sizes.
T.T.H. Multi Etcher and 3 D.S.
FILING AND SAWING MACHINES
VELOX 10in. Hacksaw.
TAYLOR Cutting Off Machine.
EDGWICK Filer.
RAPIDOR No. 1 Hacksaw.
THIEL No. 17 Bandsaw.
WICKSTEED Cold Saw No. 1, 6in
GEAR CUTTERS
SYKES HV 14 Hobber.
PETERMANN No. 2.
MAXICUT 7in. by 2in. by 6 D.P.
RAPIDAN No. 1½, 21in. dia. gears.
FELLOWS "Hourglass."

GRINDERS (Cylindrical)
PRECIMAX MPB 10 by 48.
MYFORD MG.12. New.
PRECIMAX MPH Plain. 10 by 24.
PRECIMAX U.P.J.-Universal. 12 by 48.
NORTON 6 by 18 Hyd. Type C.
NORTON 10 by 36. Type C.
GRINDERS (Miscellaneous)
J. & S. 12in. by 24in. 30S T. & C.
EXCEL T. & C.
SCRIVENER No. 1 C.B. Centreless.
JONES & SHIPMAN Carbide.
HERBERT HUNT No. 1A, 3 & 4 Drill.
GRINDERS (Surface)
ABRASIVE No. 1½ 15 × 10.
WRIGHT 8in. Table.
ROBOT 18 by 6.
SNOW P24, 24in. by 8in., Hyd.
ABWOOD 18 × 6 Vertical.
P. & W. Vertical Spindle, 36 by 14.
GRINDERS (Internal)
SMART & BROWN.
SAACKE Model VJI, Jig.
GUILLOTINES
RUSHWORTH 3ft. Treadle.
KEETONA 4ft. Treadle.
KEETONA 4ft. × 14G. Power
HONER
SUNNEN Type LA.
KEYSEATERS
EDGWICK No. 1.
CARTER & WRIGHT No. 2, 24in. by 1¼in.
LATHES
COLCHESTER MASCOT 8½in. by 6ft. 6in.
COLCHESTER Triumph.
EDWARDS 12in. Spinning.
WILLSON 7¼in. by 3ft., S.S. & S.C.
BRADFORD 8in. S.S. & S.C.
RYDERMATIC No. 12 Multi Tool.
CARDIFF 7in. by 60in.
DENHAM 5¼in. S.S. & S.C.
LE BLOND 11in. by 16in. Prod.
SOAG-OXFORD 6½in. by 24in. S.S. & S.C.
SOUTH BEND 9in. (Workshop), 13in. and 14in.
SMART & BROWN 4in. S.C.
10in. GLASS 7ft. 6in. b.c. S.S. & S.C.
LEBLOND Regal 10in. swing.

MILLERS (Horizontal)
BURNERS Bench. Table 14½ × 4.
U.S. (Whitney Type) Production.
VICTORIA M2. Table 40 × 10.
KEMPSMITH No. 1G and 2G.
BROWN & SHARPE No. 12 and 000 Prod.
CINCINNATI 08, & 1-18 Prod.
BROWN & SHARPE No. 2 Univ. Light.
CENTEC No. 2. Table 12in. by 3½in.
SUNDSTRAND No. 00 Rigidmill.
BURKE. Table 16 × 3½.
ARCHDALE 28in. Mfr. and G.P.
CINCINNATI 3-24 Hyd.
HERBERT 1S. Table 18in. by 8½in.
MILLERS (Vertical)
RICHMOND VHM. Table 26 × 8.
VICTORIA V2. Table 40 by 10.
ARCHDALE 30in. Table 48 by 12½
HERBERT 15S. Table 50 by 10½.
PRESSES (Power)
BLISS No. 8.
BESCO TVO Bench, 4 ton.
O. & S. 30 tons straightening.
BESCO EB4, 40 tons. New.
TAYLOR & CHALLEN B2, 10 ton.
RHODES No. 19. 10 ton.
SCHULER VZZ 15 ton d/s gripper feed.
RIVETERS
ROTORIVET No. 5 Hammer.
TURNER RS5 and RH14/12.
SCREWING MACHINES
OSTER 1in.-6in. Pipes No. 326.
ATLAS No. 2 3in.-6in. (Unused).
SHAPERS
INVICTA 4M 18in.
AMCO 6in. Bench.
NEWEY 14in.
TAPPERS
HULLER No. 2 ⅞in. Cap.
SUPERIOR ⅝in.
JONES No. 26. 2 B.A.-⅝in.
THIEL Nos. 3 & 4.
J. & S. Electrotap ½in.
THREAD MILLERS
FACKS Plain, cap. 3in. by ⅝in.
REINECKER 8 by 72in.
LEES BRADNER Mod. 40. 6½in. H.M.
HANSON WHITNEY. 8in. by 40in.

Two No. 6SP Potter & Johnston Chucking Automatics, with self-contained motor drive, 16 h.p. 400/3/50, 30in. dia. air-operated chuck, 14in. dia. hole and single cross slide.—LEE & HUNT, LTD., Crocus Street, Nottingham.

Woodhouse & Mitchell 369 Turret Mill, 36in. by 9in. table, power-fed table, motorised 400/3/50. Two months old.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

Universal Diamond Wheel Tool Grinder for Chipbreaker Grinding, etc.—WILCOX, LTD., Barr Street, Birmingham, 19. Northern 1234/5.

Lang 7in. A.G.H., Toolroom Centre Lathe. 30in. b.c. M/D. 400/3/50.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1. 'Phone: TERminus 0167/8/9.

Ward 3A: 1½in. Capacity Herbert and Atlas 1in. capacity, and Exacta ¾in. capacity Bar Capstan Lathes. Herbert 2¼in. capacity Bar Turret Lathe. Gisholt No. 4 Simplified Chucking Capstan Lathe. All 400/3/50.—HICKS MACHINERY LTD., 26 Addison Place, London, W.11. Tel.: PARk 2333.

Nearly New, 1,000 Ton Eumuco Coining and Sizing Press, 2in. stroke, 31in. between sides. Air operated clutch and brake, with 40 h.p. motor drive. Heavy Steel Plate construction.
160 ton Hordern, Mason & Edwards high speed Friction Screw Press, type 4 SP. 13in. effective stroke, 21in. tool space, 6¾in. dia. screw. 10 h.p. motor drive.
REED BROTHERS (ENGINEERING), LTD., Replant Works,
Woolwich Industrial Estate,
London, S.E.18.
Telephone: Woolwich 7611/6.

TAYLOR & CHALLEN Model B3 Geared 40-ton Power Press, 5in. stroke, open-fronted.

PARKES (MACHINE TOOLS) LTD.
WITTON ROAD, BIRMINGHAM, 6.
Tel.: EASt 1742.

HERBERT NO. 7 JUNIOR COMBINATION TURRET LATHE, FLAMARD BED spindle speeds 30 to 750 r.p.m. Motorised 400/3/50 at **£425.**

Box V913, MACHINERY, Clifton House, Euston Road, N.W.1.

Norton Foot Presses For Sale. Good used machines on stands. Type FPL. Stroke 2in., centre to back 3½in., tee slotted bed 10in. × 6½in., hole in bed 3in. diameter, weight 2½ cwts.—Photo, etc., from F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1. Euston 4681, or 41, Water Street, Birmingham 3. Central 7606.

Cincinnati No. 2 Dial Type Horizontal Milling Machine. High speed model. Table size 53in. × 12in.—BOX V926, MACHINERY, Clifton House, Euston Road, N.W.1.

Churchill No. 2 Centreless Grinding Machine, complete with motor, starter, etc. Plunge and through grinding attachments. Perfect condition.—BOX V923, MACHINERY, Clifton House, Euston Road, N.W.1.

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AUTOMATICS

WICKMAN 5-spindle Bar Automatics 1⅛in. capacity. Serial Nos. 423464/5.

BROWN & SHARPE OOG Bar Automatic, Vertical Slide, Bar Strand, turret, tools, collets. Serial No. 12715.

BORER

RICHARDS 48in. Double Upright Vertical Boring and Turning Mill, two swivelling toolboxes on cross slide.

CAPSTAN & TURRET LATHES

WARD 2A Bar Capstan Lathe, fitted collet chuck, speeds 71 to 1,541 r.p.m. Wartime manufacture.

HERBERT 4BS Bar Capstan Lathe, fitted turret toolholders, pump, bar feed, speeds 30 to 511 r.p.m.

HERBERT No. 20 Combination Turret Lathe, 7⅛in. diameter spindle, 28in. swing over bed, 97in. distance spindle to turret. Speeds 5 to 201 r.p.m.

CENTRE LATHES

LE BLOND Heavy Duty 33in. swing by 28ft. between centres, S.S. & S.C. Lathe, late type, all geared headstock, twin saddles, taper turning, 32in. diameter, four-jaw chuck, 25 h.p. A.C., 3-phase electrics, speeds 4 to 255 r.p.m.

BROADBENT 14in. S.S. & S.C. Gap Bed Lathe, admits 90in. swings in gap 50in., speeds 5·5 to 204 r.p.m. Well equipped Nearly New.

BINNS & BERRY 12¼in. S.S. & S.C. Gap Bed Lathe, admits 7ft. 6in. between centres, speeds 12 to 600 r.p.m. NEW.

COLCHESTER TRIUMPH 7¼in. by 48in. All-geared Head Gap Bed Lathe, speeds 40 to 800 r.p.m. NEW.

DEAN SMITH & GRACE Model "AN" 7¼in. by 48in. S.S. & S.C. Straight Bed Lathe, speeds 11 to 490 r.p.m. Serial No. 20300.

WILLSON Mark V 7¼in. by 48in., S.S. & S.C. Gap Bed Lathe, admits 48in., speeds 54 to 954 r.p.m. and 37 to 739 r.p.m. NEW.

DEAN SMITH & GRACE Type "A" 7in. by 31in. S.S. & S.C. Gap Bed Centre Lathe, speeds 11 to 490 r.p.m. Serial No. 21303.

REIDEN 7¼in. by 40in. S.S. & S.C. Gap Bed Toolroom Lathe, fitted taper turning attachment, pump, 3-jaw chuck, speeds 25 to 1,350 r.p.m. NEW.

MITCHELL 6¼in. by 64in. S.S. & S.C. Gap Bed Centre Lathe, taper turning attachment, speeds 27 to 400 r.p.m. Nearly New.

MYFORD Super Seven Lathe, 3¼in. by 19in., speeds 25 to 2,150 r.p.m. NEW.

DRILLING MACHINES

RICHMOND S.R.2 36in. Radial Drill, elevating table, suds pump. NEW.

JONES & SHIPMAN 30in. Model 921, 2 spindle Manufacturing Drilling Machine. 1¼in. capacity, speeds 39 to 825 r.p.m. Table 42in. by 24in.

PROGRESS 3A Pillar Drilling Machine, Circular table. NEW.

THIS WEEK'S SPECIAL

UNION BFT. 80 Horizontal Borer, 3¼in. diameter traversing spindle, fitted facing head, maximum distance facing head and outer steady 88½in. Table 35½in. by 44½in. Used three months only. Nearly new condition. £1,000 below to-day's cost price.

GRINDERS

JONES & SHIPMAN 18in. by 6in. capacity Hydraulic Horizontal Spindle Surface Grinder, Model 540. Nearly New.

BURDETT Hydraulic Horizontal Spindle Surface Grinder, capacity 18in. by 6in. by 10in. NEW.

LANDIS Hydraulic Universal Grinder, type "C", capacity 10in. by 24in. Serial No. 27916.

MYFORD M.G.12 Plain Cylindrical Grinder, capacity 5in. by 12in. NEW.

NEWALL Model 420 Thread Grinder. Well equipped. Built 1943.

MILLING MACHINES Vertical

CINCINNATI No. 4 Dial Type Vertical Milling Machine, table 78½in. by 16½in. rapid and power traverses 42in. by 16in. by 16in. Speeds 18 to 1,300 r.p.m. British built 1941.

BIERNATSKI No. 5 Swivel Head Vertical Milling Machine, table 78in. by 19in., traverses 49in. by 15in. by 35in., speeds 15 to 450 r.p.m.

ASQUITH two-spindle Vertical Milling and Profiling Machine, type LDP, speeds 250 to 3,000 r.p.m. Nearly New.

Universal

CINCINNATI No. 4 Dial type Universal Milling Machine, table 78½in. by 16½in., rapid and power traverses, 42in. by 14in. by 19in. Speeds 18 to 1,300 r.p.m. With Universal Vertical Attachment. British built 1947.

REIDEN H.F.30 Universal Milling Machine table 59in. by 14⅛in., rapid and power traverses 39⅜in. by 11⅛in. by 15⅛in., speeds 44 to 1,457 r.p.m. NEW.

VICTORIA U.2 Universal Milling Machine, table 45in. by 11in., power feeds 29½in. by 65in. by 16in., speeds 30 to 1,010 r.p.m. NEW.

RICHMOND No. 3 Universal Milling Machine, table 48in. by 11in., rapid and power traverses 30in. by 8in. by 16in., speeds 20 to 1,000 r.p.m. NEW.

DENBIGH C.4 Universal Milling Machine, table 46in. by 10in., automatic longitudinal feed 36½in., speeds 13 to 400 r.p.m. NEW.

Horizontal

ARCHDALE 20in. Plain Horizontal Milling Machines, table 40in. by 10in., traverses 20in. by 5½in. by 12in., speeds 30 to 615 r.p.m.

CINCINNATI 1/12 Automatic Milling Machine, table 35in. by 10in., speeds 50 to 1,500 r.p.m. British built.

SHAPERS & SLOTTERS

ALBA 6S 24in. stroke Shaper, with vice. As New. Built 1957.

INVICTA 6M 24in. stroke Shaping Machine. NEW.

ROYAL 10in. stroke Shaper. NEW.

BUTLER 8in. stroke Toolroom Slotter, 20in. diameter table. Built 1939.

VARIOUS

BRONX 10ft. by ¼in. capacity Press Brake, 150-ton, Series 158, fitted 15 h.p. motor, 25 strokes per minute. Weight 17 tons. Delivery immediate. NEW.

CINCINNATI 10ft. by 3ft. by 3ft. Planer with two toolboxes on the cross-rail.

VELOX 10in. Hacksaw. NEW.

All machines motorised 400–440 volts, 3 phase, 50 cycles, A.C. supply.
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Q2

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AVAILABLE FROM STOCK

All machines listed below are at our Works in Sutherland Walk, Walworth Road, S.E.17.

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HERBERT Auto. Junior.
HERBERT 3A Chucking Auto.
INDEX OR12 Auto.
ACME-GRIDLEY, Type R, 4-spindle, ⅜in. capacity.
ACME-GRIDLEY, Type R, 4-spindle, 1¼in. capacity. (2 machines.)
WICKMAN 4mm. Swiss Type.
RYDERMATIC No. 12 Multi Tool Lathes.

BORERS.

New GRAFFENSTADEN AF.075 Horizontal Borer, 3in. dia. travelling spindle, 17¾in. dia. faceplate.

GRINDERS.

ABWOOD Vertical Spindle Surface.
BROWN & SHARPE No. 2 Surface Grinder.
NORTON Surface Grinder, hydraulic, 18in. by 6in.
JONES & SHIPMAN Fig. 62M Plain Cyl. 8in. dia. by 10in.
LANDIS 10in. by 18in. Plain Grinder.
JONES & SHIPMAN 10in. by 27in. Semi-Universal.
CHURCHILL 24in. by 10in. Universal.
PRECIMAX Type UPJ 12in. by 36in. Universal.
BRYANT 16C 16in. Internal Grinder.

CAPSTAN LATHES.

HERBERT No.0 ¼in. collet cap. (2).
MURAD ⅜in. Capstan Lathes (2).
SOUTHWARK No. 2 1¼in. Capstan Lathe.
WARD 2A Capstan Lathes (6), with 1¼in. collet chucks and bar feed. Machines have 2 speed motors and power feeds to both saddle and turret.
New MODERN 2C 1¼in. bar feed capacity.
HERBERT No. 3 High Speed Capstan, Air Chucking. Spindle speeds 60-1,500 r.p.m.
DRUMMOND Type K Capstan Lathes (2).
GISHOLT No. 4 Friction Head Capstan.
LIBBY 4R 2in. Capstan Lathe. Bar feed.
BARDONS & OLIVER No. 5 Capstan Lathe.
HERBERT No. 7 Turret Lathe.
FOSTER No. 2B Turret Lathe.

CENTRE LATHES.

New BOXFORD 4¼in. Type A.
New COLCHESTER CHIPMASTER, 5in. by 20in.
SOAG OXFORD 6¼in. Centre Lathe.
SOUTHBEND 13in. swing taper turning.
WILLSON 8¼in. A.G.H. Lathe.
CARDIFF 8¼in. by 48in. Lathe.
New COLCHESTER ASCOT 8¼in.

MILLERS.

New CHRISTEN Swiss Universal Tool and Die Mill.
HERBERT No. 1 Horizontal.
New VICTORIA U1 and U2 Universal.
ARCHDALE 20in. Horizontal Mills (3).
ARCHDALE 28in. Horizontal Mill.
OLIVETTI FP2 Manufacturing Miller. Table 52¼in. by 14¼in. Longitudinal traverse 39¼in.
New GRAFFENSTADEN Model GH3 Plain Horizontal, table size 67¾in. by 16¼in.
New TAYLOR Vertical, table 17¾in. by 5¼in.
RICHMOND VHM Vertical Mill
New VICTORIA V2 Vertical.
New GRAFFENSTADEN FV.102 Vertical Mill. Table 51in. by 11¾in.; 39¾in. longitudinal traverse.
HOLROYD T117 Thread Miller.
HELLER Automatic Thread Millers (4).

MISCELLANEOUS.

JONES & SHIPMAN 2-spindle Pillar Drill, with No. 3 M.T. spindle, power feed.
New VELOX 7¼in. and 10in. Hacksaws.
New ESSEX 18 Bandsaw.
New RICHMOND SR2 3ft. Radial Drill.
New ALBA 18in. Shaper.
MAIDEN Bar Chamferer, ¼in.
New Fly Presses up to No. 6.

All Machines motorised 400/3/50 unless otherwise stated.

Herbert No. 18P Plain Horizontal Milling Machine. Table 57in. × 13in. M/D. 400/3/50.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1. 'Phone: TERminus 0167/8/9.

Bandsaws. E. H. Jones, 12in. Toolroom, MIDSAW 30in. Horizontal also 30in. Woodworking Bandsaw. All 400/3/50. —HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARK 2333.

No. 2C Ward Motorised Bar Feed Capstan Lathe. Lever chuck, 1¼in. cap. Swing over bed 13¼in., 12 spindle speeds 48-2,041 r.p.m., 1950 machine. Excellent condition.—LEE & HUNT, LTD., Crocus Street, Nottingham.

Victoria (New) U2 Machine, table 45in. by 11in., motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

JOHN HANDS 400-ton Friction Screw Press, 22in. stroke, distance between columns 27¾in.

PARKES (MACHINE TOOLS) LTD.

WITTON ROAD, BIRMINGHAM, 6.

Tel.: EAS 1742.

NEWALL USED MACHINE DIVISION

HAVE CAPACITY AVAILABLE FOR REBUILDING MACHINE TOOLS UP TO A CAPACITY OF 30 TONS.

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Oundle Road Works, ORTON LONGUEVILLE, PETERBOROUGH,

Telephone 6116

Selections from our Stocks of NEW MACHINES for IMMEDIATE DELIVERY

MITCHELL 16¼in. Lathe, 17ft. 9in. between centres.
MARTIN 13in. Gap Bed Lathe, admit 13ft. 1in. between centres.
MEUSER 11¾in. Gap Bed Lathe, admit 80in. between centres.
CARDIFF 84in. Gap Bed Lathe, admit 48in. between centres.
KRETA 8in. Gap Bed Lathe, admit 40in. between centres. (Infinitely variable speed.)
WILSON 7¼in. Mark V Gap Bed Lathe, admit 36in. between centres.
CARDIFF 7¼in. Gap Bed Lathe, admit 40in. between centres.
MASTER 8in. Gap Bed Lathe, admit 36in. between centres.
EXCEL No. 4 Filing and Sawing Machine.

OLIVETTI 13¾in. by 48in. Hydraulic Production Cylindrical Grinder.
EXCEL No. 3C Hydraulic Surface Grinder.
BURDETT 18in. by 6in. Hydraulic Horizontal Surface Grinder

BEACON & MILFORD 10in., 12in., 14in. and 16in. Tool Grinders.

HERBERT, Q. & S., SWIFTCUT and **FORTUNA** 6in., 8in., 10in. and 12in. capacity Hacksaw Machines.

VICTORIA O2 Omnimill.
VICTORIA V1 Vertical Miller, 40in. by 11in.
VICTORIA V2 Vertical Miller, 45in. by 11in.
VICTORIA V3 Vertical Miller, 60in. by 12¼in.
SEGIC Vertical Miller, 22in. by 9¼in.
TAYLOR Vertical Miller, 17¼in. by 5¼in.
MARLOW Vertical Miller, 22in. by 6in.
VICTORIA U0 Universal Miller, 36in. by 9in.
VICTORIA U1 Universal Miller, 40in. by 11in.
VICTORIA U2 Universal Miller, 45in. by 11in.
VICTORIA U3 Universal Miller, 60in. by 12¼in.
VICTORIA U4 Universal Miller, 72in. by 15in.
RICHMOND No. 3 Universal Miller, 48in. by 11in.
DENBIGH C2 Plain Miller, 54in. by 10in.
DENBIGH C4 Plain Miller, 46in. by 10in.
RICHMOND 4ft. Radial Drill, 2in. cap.
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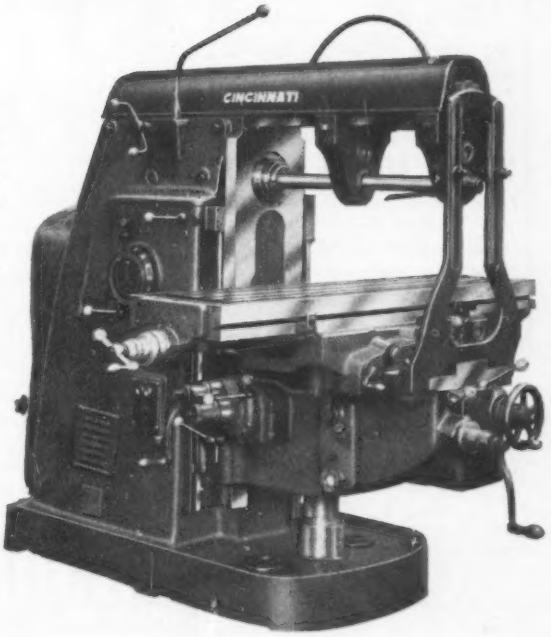

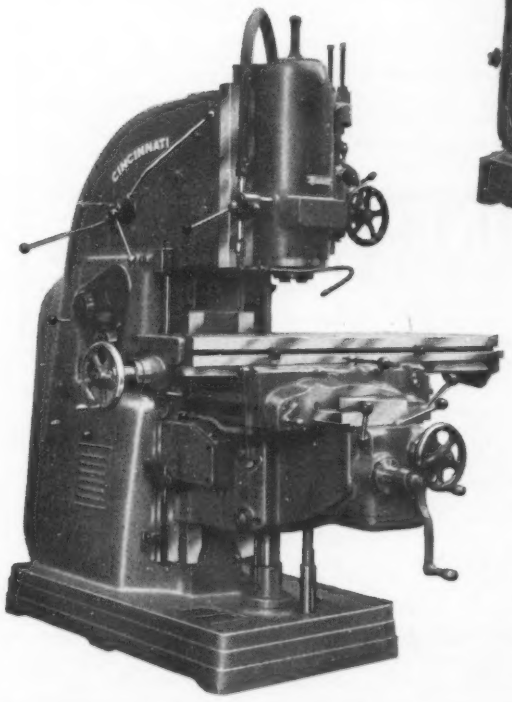

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Thiel 58 Universal Milling Machine. £475.
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B.S.A. ¾in. Single Spindle Auto. £525.
Newall 14in. by 6in. Hori. Spindle Surface Grinder. £197 10s. 0d.
Abwood Vertical Spindle Surface Grinder. £175.
Autometric Jig Boring Machine. £525.
Progress 4E Drilling Machine. £140.
Parkson Horizontal Milling Machine. Table 51in. by 11in. overall. £195.
Speedax No. 2 Riveter. £35.
Jos. Heap 1in. Tangential Screwing Machine. £165.
Ward OE Capstan. Bar feed. £165.
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Willson 7½in. S.S. & S.C. Lathe. £235.
Lang 8½in. S.S. & S.C. Lathe. T.T. A.G.H. £695.
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HERBERT No. 5 Auto., complete with Air Chuck. **£200**

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HERBERT No. 4 Capstan, speeds to 511 r.p.m., steel tray. Ball Chuck and misc. equip., in good condition. **£120**

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POLLARD CORONA 15 AK Single Spindle Drill. **£45**

CINCINNATI 1-12 Automatic Milling Machine. **£325**

CINCINNATI 1-18 Automatic Horizontal Milling Machine. **£275**

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Colchester Student S.S. & S.C. Centre Lathe, 6in. height by 24in. between centres, motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

Classified Advertisements (*PLANT FOR SALE, contd.*)

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Telephone: Woolwich 7611/6.

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Classified Advertisements (*SITUATIONS VACANT, contd.*)

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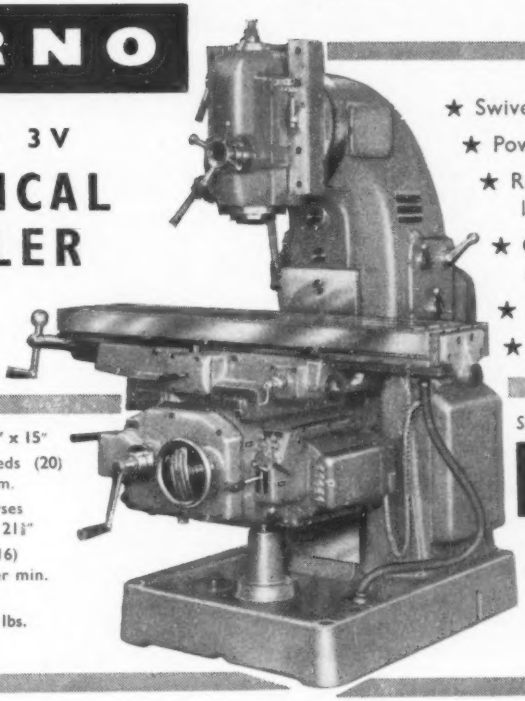

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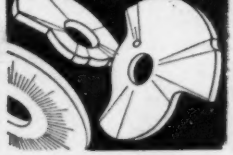

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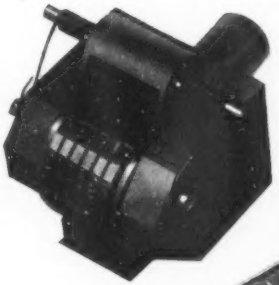

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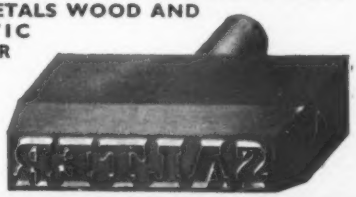

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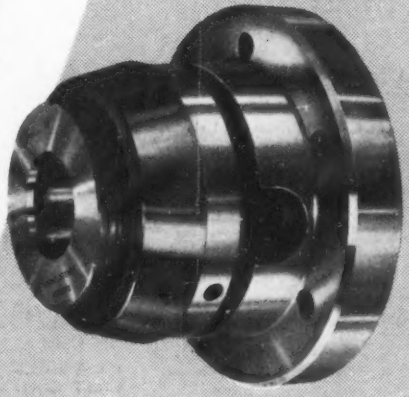

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